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SUPPLEMENTAL SOURCES

Energy Production Output for April

HK0506115990 Beijing CEI Database in English 5 Jun 90

[Text] Beijing (CEI)—Following is a list of China's total output of primary energy production in April, 1990, released by CSICSC [China Statistics Information Consultancy Service Center]:

Item	Unit	1-4/90	4/90	p/c over 1-4/89
Total output (10,000 t of standard coal)		31825.0	8829.0	6.60
a.Raw coal	10,000t	32773.0	9315.0	8.10
b.Crude oil	10,000t	4508.1	1125.4	1.30
c.Natural gas	100 m cm	49.70	12.30	2.30
d.Hydropower	100m kWh	326.0	100.5	9.20

Energy Production Output for May

HK1106105390 Beijing CEI Database in English 11 Jun 90

[Text] Beijing (CEI)—Following is a list of China's total output of primary energy production in May, 1990, released by CSICSC [China Statistics Information Consultancy Service Center]:

Item	Unit	1-5/90	5/90	p/c over 1-5/89
Total output (10,000 t of standard coal)		40843.0	9028.0	6.60
a.Raw coal	10,000t	42117.0	9360.0	7.30
b.Crude oil	10,000t	5676.1	1168.0	1.30
c.Natural gas	100 m cm	62.69	13.1	2.00
d.Hydropower	100 m kWh	450.8	123.9	8.30

National Energy Situation Reviewed

40100060A Beijing JINGJI GUANLI in Chinese No 4, 90 pp 15-23

[Article by Xie Ranhao [2836 3544 3185] and Han Suqin [7281 4790 0530], edited by An Luming [1344 6424 2494]: "China's Energy Industry: The Present Situation, Problems, and Development Measures"]

[Excerpts] In 1949, China's raw coal output was only 32.4 million tons, crude oil output was 120,000 tons, and generated electricity was 4.3 billion kWh.

In 1978, the national output of raw coal was 610 million tons, crude oil output was 100 million tons, and generated electricity was 300 billion kWh.

In 1989, the national output of raw coal was 1.04 billion tons, 31 times the 1949 figure and 80 percent up on the 1978 figure. Output of crude oil was 137.6 million tons, up 1,145 times over 1949 and 37 percent up on the 1978 figure. The electricity generated was 580 billion kWh, 133 times the 1949 figure and 93 percent up on 1978.

The above figures show that China's energy industry, like the other industrial sectors of its national economy, has through 40 years of development, and especially the last 10-plus years of reform, opening up, and development, already achieved quite a substantial base.

Today, our country has become the third largest energy producer in the world. In this, raw coal output has leaped from ninth place in the world to first place, crude oil production has risen from an insignificant position to fifth place, and electricity generation has risen from lower than 20th position to fourth position in the world.

The Present Situation: No Cause for Optimism

China's energy industry has realized world-shaking achievements. However, at the same time, the energy supply situation throughout the whole country is extremely tight, and does not allow optimism. The situation has become even more serious since June 1989. [passage omitted]

Beijing: Because of the lack of electricity, the frequency of switch-throwing due to limited electricity has greatly exceeded that of last year. A responsible person of the Beijing Municipality Electricity Supply Bureau said: "Throughout the whole of Beijing, there are 1,000 electrical circuits, and we daily throw switches 1,500 times.

Guangzhou: 23 November 1988. The whole city was officially implementing a plan for reducing electricity usage. For residential electrical circuits, a rotational system of electricity stoppage for one to two evenings in turn was implemented.

Henan: The office building housing the provincial party committee and provincial government has come within the scope of the "blackouts." It is difficult to guarantee even the electricity used for production in the vast rural areas. During the spring irrigation season for wheat, many farmers find it very difficult to run their pumps. They connect up the electricity, throw the switch, and the pump starts to draw water. However, it often happens that after a few minutes the electricity is cut off and may be stopped for several days. In order to guarantee the drawing of water, many peasants have no option but to have the whole family taking turns in irrigating the fields. This is because no one can say when the electricity supply will return.

Jiangxi: The whole of the provincial capital Nanchang was, from the end of 1988 to early 1989, frequently half-lit and half-dark at night. Each week the Yichun region had five nights without electricity and, when the whole city was without electricity, the shops had no option but to do business under candle-light.

In discussing the shortage of electricity, State Councillor Zou Jiahua has some feeling for the subject. When he went to Chengdu on business, on the way from the airport to the hotel, all the lights were out. When he went on business to Shenyang, he also experienced a regional "blackout" due to limited electricity. He said that the tightness in electricity supply since June 1988 has had two characteristics distinguishing it from that in the past. First, partial shortage has changed into overall shortage. In the past, it was only east China and the northeast region which lacked electricity. Now, even the southwest and the northwest lack electricity. Second, in the past, it was only in a few periods during the year that supply was tight. Now, the shortage extends throughout the whole year.

Ren Yeqing, deputy head of the State Planning Commission, has said that the tightness in electricity supply has already become a major factor restricting our country's economic construction.

Please Have a Look at a Few Scenes

In Shanghai, the largest industrial base in our country, because of a shortage of electricity, many factories have to stop work for 3 or even 4 days every week. Some township and village enterprises in Zhejiang and Jiangsu can only work 2 days out of every week. Because of the insufficient supply of electricity, the output of the Guizhou Aluminum Plant and the Qingtongxia Aluminum Plant in Ningxia in 1988 reached only one-third of their production capacity.

Some industries which require a continuous, regular supply of electricity, such as glass manufacture, textile production, metallurgical processing and so on, often have to discard faulty products resulting from electricity stoppages. For example, textiles are of uneven thicknesses and the color of dyes is not consistent. Statistics show that in the last 8 to 9 years, the industrial losses resulting from electricity stoppages total a whopping 200 billion yuan.

"The shortage of electricity is essentially a shortage of coal." Yu Hongen, the minister of coal and general manager of the China Unified-Distribution Coal Mining Corporation, said this when analyzing the overall shortage of electricity which has occurred since the second half of 1988.

Information from various regions also verifies this claim.

From January to November in 1988, the delivery rate for coal at the various generating plants in the East China grid was only 86.3 percent. The shortfall of coal was approximately 4 million tons. This resulted in the stocks of coal at the various generating plants falling a further 220,000 tons below their historical low points. In many plants, the stores of coal were insufficient even for 1 day's power generation. The situation of plants having to close down to await coal became increasingly serious. In December of that year, the installed capacity of those generators closed down to await coal was 1.55 million kW. The various provinces and cities in east China thus had no option but to adopt emergency electricity restriction measures.

In November 1988, the Niangziguan power plant situated in the coal heartland of Shanxi saw its electricity-generating coal inflow fall from 3,000 tons to 250 tons, and was the first to submit an emergency notification to the provincial electricity management bureau. Subsequently, the electricity management bureau received emergency notification telegrams relating to fuel coal from 13 major power plants, including the Yongji, Shentou, Huoxian, and Taiyuan No 1 plants.

At the beginning of 1989, the seven major generating plants at Qinling, Baoji, Hancheng, Huxian, Weihe, Lueyang, and Baqiao in the coal fields of Shaanxi also frequently sent reports indicating shortage of generating coal to the provincial electricity management bureau. The situation at Qinling was particularly bad, with the supply of generating coal being extremely tight. The four generators of the plant, with 200,000 kW capacity, had to be closed down in turn.

Coal is the "grain" of industry. When generating coal is lacking, the coal for other industrial uses is also in extremely tight supply. In data made public by the State Statistical Bureau in March 1989, it was noted in February and March 1989, due to lack of coal, there had been declines to differing degrees throughout the country in the output of major materials and products including steel, steel products, pig iron, copper, chemical fertilizers, sulphuric acid, and caustic soda. Steel output was down 9.1 percent from the same period in the previous year, nonferrous metals were down 2.2 percent, and chemical fertilizers were down 9.4 percent. Further, the insufficiency of the output of these basic industries was in turn a restricting factor for the next cycle of industrial production.

The tightness of coal meant that the shortage in Shanghai in 1989 reached 2 million tons. Quite a number of chemical fertilizer enterprises in Zhejiang and Jiangsu stopped production to await coal. The residents of Beijing also had to form long queues to buy coal.

After annual production of coal reached 870 million tons in 1985, supply exceeded demand in the country's coal market for the next 3 years. This situation remains fresh in people's memories and they are puzzled by the present phenomenon. In 1988, the national coal output reached 980 million tons. This was more than 50 million tons more than the previous year and was also the biggest increase in production in the 3 years since 1985. What, then, has given rise to the shortage of coal? Even electricity generation cannot be guaranteed.

Beginning in the latter half of 1985, the state began to engage in tightening of the overheated economic atmosphere which had been apparent since the end of 1984. This resulted in the speed of economic development

being in a stage of quite low growth for about 18 months. Then, in the spring of 1987, the "chill" turned into "heat."

Also, for successive years during the period of the Sixth 5-Year Plan, the growth in coal production had exceeded growth in consumption, and during the 3 years after 1985 there were sufficient stocks of coal. At the same time, in order to satisfy the needs of agriculture and the processing industry, the state used foreign exchange to import a large volume of chemical fertilizer, cement, steel products, and other products which require large energy input to produce. The increase in imports reduced the demand for coal consumption by these major coal-consuming industries.

In 1988, the situation changed. On the one hand, the speed of economic growth remained high. On the other hand, due to 2 years of consumption, the coal stocks were depleted and the proportion of imports of high energy-consumption products was reduced. These two factors collided and all the industries which required coal could only seek it from the coal produced in that year. Although the coal output increased greatly that year, the growth in consumption was several times greater and naturally there was insufficient coal to meet needs.

After the beginning of winter in 1988, an electricity generation "landslip," a chemical fertilizer production "landslip," a steel products production "landslip," a nonferrous metals production "landslip," and a textiles production "landslip" occurred successively, while coal for household needs became tight and it was difficult to meet coal export contracts. Thus, in a situation where coal supply could not meet demand, the meeting of needs in one place could only be achieved by neglecting needs somewhere else.

The overall tightness in the coal supply-demand situation has also resulted in the coal circulation channels becoming the most chaotic in the overall circulation sphere.

The basic way of dealing with the tight coal supply-demand situation lies in increasing coal production.

Can we produce more coal at present?

Please listen to the answers from responsible persons of the governments of the major coal-producing provinces.

Wu Junzhou, deputy governor of Shanxi Province, said: It is very difficult for Shanxi to produce more coal. In another 2 to 3 years, Shanxi coal production may experience a "landslip."

Zhang Bin, a consultant to the Shaanxi provincial government, said: Shaanxi's coal resources are bountiful but at present it lacks coal. In Xi'an, the price of a ton of negotiated-price coal is several times, or even 10 times, higher than the price of state unified-distribution coal.

Long Nian, deputy governor of Anhui Province, said: Coal sent from Anhui used to constitute 35 percent of the coal used by the various provinces of eastern China, but now we have become a province lacking coal.

Li Chunting, deputy governor of Shandong Province, said: The supply-demand contradiction for coal in Shandong is also very major, with a shortfall of several million tons. It is hoped that the state will assist in resolving the problem.

Liu Yuan, deputy governor of Henan Province, said: Now, the coal shortfall for the province is 2 million tons annually. Can we increase production? It will be difficult!

"Why must we let coal strangle us? If there is insufficient coal to generate electricity, we should burn more oil!"

Since the tightness in electricity supply began in the latter half of 1988, we have often heard such comments.

Actually many comrades, including leading comrades at the central decisionmaking levels, also once thought in this way. However, later, they had to admit that the matter was not so simple.

Indeed at present, our country is one of the major oil-producers in the world. However, with its huge population, China, although a major oil producer, is a small per-capita consuming country. In 1989, our crude oil output was 29 percent up on 1978. With an output of 137.6 million tons, we ranked fourth in the world. However, per-capita consumption has hardly grown at all. It is about the same as 10 years ago, and is about one-fifth of the world average.

Information from the oil industry shows that even if our country's population does not increase, for quite some time to come, per-capita consumption of oil will not be able to increase by much.

The reason is: Oil is a resource which cannot be regenerated. Once it is used, we have that much less. The role of this irresistible law of natural progressive decline brings with it increasingly complex factors. From the middle of the 1980's, the net growth in crude oil output of our oil industry experienced a declining trend. In 1986, the production was 5.78 million tons up on 1985. In 1987, the growth was 3.45 million tons, in 1988 it was 3 million tons, and in 1989 output was only 600,000 tons up on the previous year. In 4 years, the rate of growth fell by eight-ninths.

The growth in oil output is determined by increases in verified reserves. Although our country has made major discoveries of oil and gas in the northern and central parts of the Tarim Basin in Xinjiang, and it may be possible to create a major oil field there, to really form production capacity and extract oil involves a process which can only be looked at in terms of "years." Thus, of

the reserves which have already been verified but not drawn on, those which can be put into production in the near-term can only provide 1 year-plus of production capacity.

Thus, at present, the calls of "oil shortage" are almost the same as those of "electricity shortage" and "coal shortage." These complaints continue without end. In Shanghai, the oil resource shortfall in 1989 was at least 400,000 tons. In March, after the residents of some areas made a hubbub and clamored for coal, the leaders of the relevant departments requested the coal corporation to urgently rush-transport some coal there. However, when the truck convoy went to fill up their tanks, all the stations had signs up saying "No Gasoline."

Beijing: Although the State Council and relevant ministries and commissions gave assistance, in 1989 the shortfall between the supply of gasoline and the lowest level of social demand was still 75,000 tons. In the middle of October, the 25 oil depots of the city with storage capacity of over 180,000 tons, only held 15,000 tons of gasoline and diesel. One-tenth of the 100-plus filling stations throughout the city were completely sold out.

In Shanxi in 1988, the gasoline shortfall was over 400,000 tons, and this grew larger in 1989.

In Hunan, over 5,000 vehicles from other provinces cross its territory every day. These alone result in a lack of 50,000 tons of negotiated-price gasoline.

In Liaoning, the Dalian Oil Refinery, despite backing onto the Liaohe oil field, has had no option, because of the shortage of oil, but to use precious foreign exchange to import crude oil in order to maintain production.

Even normal supply of oil is difficult to guarantee. How can more oil be used to generate electricity?

Our country mainly relies on coal in energy consumption and as a fuel for electricity generation, but this is not because we have some special affinity with coal. Today, when the world has entered the "oil age" in energy production and consumption, why are we unwilling to leap into the "oil age"?! And why have we not put great efforts into this? It is because we cannot and have no way to do this. This is because the situation of resources was "divinely arranged."

According to current geologically verified reserves, if we exclude nuclear energy, the energy reserves in our country, including coal, oil, natural gas, and hydroelectric resources total over 700 billion tons of standard coal. Of this energy, coal constitutes 97 percent.

The "divine arrangements" have determined that for many years past, we have had no option but to allow coal to occupy prime position in the energy production and consumption structures. It has also determined that over 70 percent of the electricity produced in our country is coal-generated, while 20 percent is hydroelectricity (of course, we now have to consider accelerating the development of hydroelectricity). It further determines that the power industry must continue to implement the policy of "using coal to replace oil and cutting back on oil burning."

It is thus that recently many energy organizations, both domestic and foreign, came to the conclusion that the situation where coal constitutes over 70 percent of the energy produced and energy consumed in our country, will not change within the next 30-50 years.

While we can say that the people feel the tightness of electricity supply when their lights do not work, their television does not work, and the refrigerator does not work, the theoreticians have, from the current situation of shortage of electricity, shortage of coal, and even greater shortage of oil, come to the conclusion that the tight energy situation has produced major losses for the economy, losses even developed countries could not bear.

According to statistics of the State Statistical Bureau, the capacity of electrical equipment used throughout the country has reached 290 million kW. Maintaining their ordinary operation requires at least 800 billion kWh of electricity. However, in 1988, the actual amount of electricity generated throughout the country was only 545.1 billion kWh. This rose to 580 billion kWh in 1989. The shortfalls in these years were respectively one-third and one-fourth of demand, meaning 254.9 billion kWh and 220 billion kWh. If we calculate on the basis that each kWh produces at least 2.5 yuan of industrial output value, the industrial output lost each year is about 600 billion yuan. This is equivalent to one-third of the industrial output value realized throughout the country in 1988 and nearly one-fourth of the figure for 1989.

Thus, Energy Minister Huang Yicheng says that the present situation is the tightest situation for energy since the end of the 1960's.

Those people who know about the energy crisis in the 1970's will appreciate the significance of the terms "tightest situation."

In 1973, during the world energy crisis, the U.S. GNP lost 3.1 percent, Japan lost 11.9 percent, West Germany lost 4.8 percent, Britain lost 4.8 percent, and France lost 2 percent.... Although the losses were much smaller than ours, it was as if the whole Western world had been hit by an atomic bomb and been turned upside down by the shock.

The Problem: Intricate and Complex

How has China's energy "anemia" come about?

The old saying is: "Ice does not freeze to 3 feet thick overnight."

The First Cause: Economic Overheating

On the night of 19 January 1989, when State Councillor Zou Jiahua met an economic delegation from the United States, the two sides discussed China's energy situation. The guests asked: What is the elasticity coefficient between China's energy industry development and economic development? Zou Jiahua told them: The elasticity coefficient is about 0.8. When they heard this, the guests were greatly shocked.

Seen from the path taken by some of the world's advanced countries, in a period of economic take-off, the growth of the electricity industry, as an industry which has to see prior advance, should have a higher speed of growth than the overall economy. The ratio between them is in general 1.1:1. However, economic movement in our country in 1988 showed that the speed of development of the electricity industry was far behind the speed of growth of manufacturing industry. The national speed of growth of electricity was 9.03 percent, while the gross value of industrial and agricultural output grew 11.4 percent. Of this, the speed of industrial growth was 20.7 percent. In both cases, the elasticity coefficient was less than 1.

The situation of the elasticity coefficient for electricity being less than 1 emerged in our country in the late 1970's and early 1980's. During the period of the Sixth 5-Year Plan, the rate of growth of electricity in our country was 37 percent. In the same period, the gross value of industrial and agricultural output grew 68 percent. Thus, the elasticity coefficient was 0.54. In the first 2 years of the Seventh 5-Year Plan, the annual rate of growth in the volume of generated electricity was 10 percent. However, in the same period, the rate of growth in the gross value of industrial and agricultural output was 14 percent. The elasticity coefficient was thus only 0.7.

The development of the primary energies of coal and oil has been about the same as that of electricity. Many years of practice have proven that a rational ratio between the speed of growth of primary energy and the speed of growth of industry and agriculture is one of at least 0.5:1. During the Sixth 5-Year Plan Plan, the ratio between the two was 0.5:1. Although there were electricity shortages in this period, the overall energy supply situation was passable. In the first 3 years of the Seventh 5-Year Plan, that is from 1986-1988, the speed of growth in primary energy began to see a marked decline, with the average annual growth being only 3.5 percent, and with an elasticity coefficient of only 0.22. This led to an overall tightness in energy in 1988.

We can see through comprehensive comparison, that because of economic overheating, the differential between energy production and the processing industry during the period of the Seventh 5-Year Plan continually expanded. This is the reason that throughout the 1980's we suffered electricity shortages every year and the reason these shortages became increasingly severe.

In 1989, through improvement and rectification, following a lowering of the speed of national industrial growth the volume of electricity generated and coal output was such that the Seventh 5-Year Plan targets could be completed 1 year ahead of time and both the elasticity coefficient for electricity and the elasticity coefficient for primary energy saw swift growth. The elasticity coefficient for electricity rose from the 1988 figure of 0.57 to about 1, while that for primary energy rose from 0.29 in 1988 to 0.7. However, the situation where overall demand for energy was greater than overall supply has still not been basically turned around. This is because the decline in the speed of industrial growth in 1989 was linked together with abnormal factors such as a weak market, stockpiling of products, shortage of funds in industrial enterprises, a large amount of electrical machinery lying idle, and much labor returning home to await employment.

The Second Cause: The Lead by Consumption

Following the country's opening up and the development of tourism, we have the situation we see today where, regardless of which major or medium-size city one goes to, one will find a forest of high-grade hotels and office buildings. However, who would have known that it is precisely these newly constructed huge buildings which chew up quite a proportion of our newly added electricity production each year.

In Beijing, prior to 1979 there were only the Beijing Hotel and a few other high-grade hotels. Today, such hotels number over 100. The annual amount of electricity used by the international trade center in the eastern suburbs is equivalent to the amount of electricity used by the entire city of Beijing in 1949.

In Guangzhou, the amount of electricity used daily by the hotels in the city in 1983 was 500,000 kWh. In 1988, this had more than doubled to 1.3 million kWh. In Shanghai, the use of electricity used by hotels quadrupled during the Seventh 5-Year Plan. The Jinjiang, Hengshan, Donghu, Huating, and Xinya hotel groups (corporations) have seen an annual increase of 50 percent in electricity use during the last 2 years.

According to statistics, there are now close to 1,000 high-grade hotels open to foreigners in our country. If we add the other various hotels, it is not difficult to imagine the huge amounts of electricity they use.

All Chinese people will agree that through the 10 years of reform, the quality of life has seen an improvement. One only has to look at the televisions, refrigerators, washing machines, video-players, and vacuum cleaners now found in people's homes to see proof of this. But at the same time as these electrical appliances have brought enjoyment to people, they have also resulted in an increase in the amount of electricity used.

According to a survey in Hengyang City in Hunan in 1987, excluding lights for illumination, there were 560,000 domestic electrical appliances of various sorts

throughout the city. If they were all in use at the same time, the electricity used would be over 77,000 kWh. This is over half of the normal allocation of power to this city. In order to guarantee the home-use electrical needs of the residents of the city, Hengyang City has had no option but, each evening, to cut back industrial-use electricity by 15,000 kWh, while the provincial power grid also has had to supply an additional 8,000 kWh.

Data show that in the last 2 years, the rate of growth in the amount of electricity used by the tourist hotels and for home-use electrical appliances has been about 20 percent a year. In this, the growth rate in Changsha, Hunan, has been 30 percent, while that in Beijing has been 31 percent.

Developing the tourism industry is a major part of developing the national economy. The production of more home-use electrical appliances is also desirable for improving people's lives. However, in a situation where the huge number of hotels are competing to attract customers with cheap prices and the occupancy rates are falling, and the flood of electrical appliances into homes is giving an even higher load to the already heavily loaded electrical industry, we have to ask: Have we built too many high-grade tourist hotels? Is our home-use appliance industry developing too quickly?

The Third Cause: Energy Consumption Is Too High

Since the beginning of the 1980's, we have done much work and achieved many good results in reducing energy consumption in producing products. In these 10 years, there has been a reduction in the per-unit consumption of two-thirds of the major energy-consuming products. This has directly saved 100 million tons of standard coal.

However, the situation of low energy utilization and high per-unit consumption of energy in production in our country is still shocking. Seen from the per-unit energy consumption of major energy consuming products, the level in our country is still 30-90 percent higher than advanced levels abroad. For example, the operational efficiency of fans and water pumps in the industrial sector is 20 percent lower than in developed countries. This alone means an excess consumption of 30 billion kWh of electricity a year. Also, within the same industry in China, the disparity between the advanced and the backward is very great. The comprehensive energy consumption in the production of 1 ton of steel ranges from a low of 1.17 tons of standard coal to a high of 2.28 tons of standard coal. The high figure is almost double the low one. In the electricity industry at present, the lowest level of coal consumption to produce 1 kWh of electricity is 330 grams, while the national average level in 1988 and 1989 was 431 grams. If we had been able to achieve the 330 gram level in those 2 years, we would have been able, by burning the same amount of coal, to have generated a further 130 billion kWh of electricity.

Thus, in the report "World Resources 1988-89" made public in the UN on 20 November 1988 and compiled by the World Resources Institute and the International Institute for Environment and Development based in Washington and London, of the 10 major countries, excepting the Soviet Union, in the amount of energy consumed to produce US$1 of GNP, China had the highest figure. The figure for China was 4.97 times the figure for France, 4.43 times the figure for Japan, 3.82 times the figure for Brazil, and 1.64 times the figure for India.

Relevant experts believe that if our energy consumption can be brought down to the level of Brazil, the amount of electricity generated in 1988 could support the industrial growth rate in that year. If the rate could be brought down to the Japanese level, the national economic growth rate could be raised by over four times.

Some people may say that the high consumption of energy is due to the fact that the situation in our country is not comparable with those of developed countries. For example, our country's mechanical and electrical products are backward and it is not easy to change this situation in a short period. This is of course a reasonable comment. However, why is it that the energy consumption of our country is so much higher than that of India, a country with conditions similar to our own?

In the last part of March 1989, the Second Session of the Seventh NPC was being convened. On the morning of 22 March, in accordance with the agenda, the various delegates were to go to the Great Hall of the People to have group discussions. At a little past 0800, when the delegates were on their way to the Great Hall, someone observed that on their bus, which could carry 40 persons, there were only eight persons, including the driver. On another similar large bus, there were only 10 persons. Even the fullest bus carried only half its capacity. There were also several buses which had no passengers at all. In a smaller bus, which clearly indicated the status of the occupants, there were only two persons.

This problem had been discussed at the people's congress session in 1987, but 1 year later the situation was still as before.

This incident shows that the high energy consumption in our country is related to the shocking waste such as the "24-hour lighting" we commonly see in our daily lives.

The Fourth Cause: The Distortion of Prices

Coal and oil are both resources which cannot be regenerated. Thus, the coal industry and the oil industry are different from machine-processing industries in which, as long as the machine tools are not broken, production can continue. When a certain amount of coal or oil is exploited, we have that much less of that resource. This is manifested in the trend whereby as reserves decrease, production also progressively decreases.

If we want to guarantee output stability, or even increase it, it is necessary to increase the amount of work put in and strengthen extraction measures. Thus, in extracting a ton of coal or a ton of oil, the coal enterprise or the oil

enterprise will have to put in twice or several times the amount of work they had to put in previously. According to statistics from the China Oil and Natural Gas Corporation, as the various major oil fields in our country have successively entered the stage of progressively declining production, when we compare the oil industry in our country in 1988 with that in 1985, we find that there was a 43 percent increase in the volume of water used in water-flooding during oil extraction. From 3.75 million cubic meters in 1985, the figure rose to 536 million cubic meters in 1988. There was also an increase in the volume of fluid produced from 364 million tons to 502 million tons. Wang Tao, the general manager of this corporation, said that this meant that although the 1988 national output of oil was 2.9 million tons up on the previous year, the amount of work they had put in was the equivalent of producing 20 million tons under normal conditions, as they had to put in six times the amount of labor.

This additional work which is necessary not only involves labor input, but also input in terms of large amounts of cement, timber, and steel products.

The increase in the amount of work and the new materials required together with the skyrocketing increases in the prices of raw and semifinished materials in recent years, have naturally led to increases in the cost of coal extraction and oil extraction. In a situation where the prices of coal and oil are seriously divorced from their value, where they are priced far too low and the prices basically do not move, the increase in costs can lead to enterprise losses.

In 1980, when the major oil fields of our country were still at their oil-extraction peak, the cost of a ton of oil was 47.89 yuan. Following their entering the stage of progressive natural decline, the cost of a ton of oil rose to 94 yuan, close to double the 1980 figure. However, the price of a ton of crude oil had only risen 5 yuan by 1988, to 110 yuan. In this way the cost, plus over 26 yuan in tax, exceeded the price of oil. The result of this was that in 1988, our country's oil industry first experienced industry-wide losses.

In 1980, although the price of a ton of oil was raised to 137 yuan, the state took a further 5 yuan in accordance with the "standard for calculating increases in compensated use of reserves," taking the taxes to 32 yuan. Thus, the enterprises did not gain a single fen of advantage from the price increases, and the industry-wide losses remained as before.

As for the coal industry, for similar reasons, it is the "veteran" debtor in the energy industry. Just in 1988 and 1989, its total volume of debt exceeded 6 billion yuan.

At present, in the energy industry, only the electricity industry has not experienced industry-wide debt, but its prospects are not good. This is because of the news that the Northeast Electricity Grid, the Yunnan Electricity Management Bureau, the Shanxi Electricity Bureau, and the Shanghai Electricity Management Bureau, which were previously large taxpayers and profit-makers, have successively slid into debt.

However, it must be pointed out that losses of the electricity enterprises are different from the losses of the coal and oil enterprises. The losses of the former result from a rise in fuel prices, a rise in operational costs, an increase in taxes, and the price of electricity not changing for several decades. If we take the Shanxi Electricity Bureau as an example, in 1988, because of increases in the price of coal outside the plans and of rail transport, as well as increases in the prices of oil, acid, soda, and water, together with sharp rises in product tax and credit interest rates, it had to pay out an additional 166 million yuan, while in the first quarter of 1989, it paid out a further 31.43 million yuan. This resulted in this enterprise, which had made 500 million yuan in taxes and profits in 1987, becoming a loss-making enterprise.

Energy enterprises are all capital-intensive enterprises. Regardless of whether we speak of oil fields, mines, power plants, or power stations, all have fixed assets of hundreds of millions or even billions of yuan. Thus, the emergence of losses will naturally affect self-transformation and self-development of "blood-making" mechanisms by enterprises. Let us take the coal industry as an example. From 1985 to 1989, the annual losses were billions of yuan and the state only subsidized a portion of the losses. The majority of the losses were met through the coal industry's own funds. This led to a situation where some enterprises could not even pay their wages. In such a situation, enterprises are naturally unable to consider renewal and increasing reserve strengths.

Over the last 10 years, the net increase of 125 million tons in coal production capacity to a large degree has been realized through reliance on the 406 comprehensive coal mining machines put into operation. However, by the end of 1989, 201 of these had been scrapped, were waiting to be scrapped, or were awaiting attention. To renew this equipment requires over 3 billion yuan. However, as the enterprises have no funds, they can only work from day to day.

The Fifth Cause: Blind Optimism

In April 1988, the new energy minister, Huang Yicheng, who was about to take up his post, called in some energy experts to have a discussion. At the meeting Huang Yicheng made a prediction which allowed no optimism: If our energy problems are not resolved well, an energy crisis could occur in 1992.

Who would have known that in June, not long after this was said, following the official establishment of the Ministry of Energy, there would already be a succession of cries about "shortage of electricity," "shortage of coal," and "shortage of oil."

The facts make one feel that the prediction, which initially appeared a little pessimistic, was actually too optimistic.

The energy difficulties we are in at present are indeed related to repeated over-optimistic appraisals of the energy situation for many years past.

Electricity: Since the beginning of the 1970's, the electricity departments have said every year that supply does not meet demand. However, various leaders did not accept this. Later they recognized it to be true, but their assessments were too optimistic and they thought that it was only necessary to cut back nonproductive use of electricity and the use of electricity by residents, and the problem of insufficient electricity could be solved. In 1986, with the flourishing of tertiary industry, there was a great increase in domestic electrical appliances. It was only then that they recognized that it was basically impossible to cut back nonproductive use of electricity in order to guarantee productive use, and that the resolution of the problem of lack of electricity had reached a stage which would brook on delay. However, the annual lack of electricity had already grown from several tens of billions of kWh to several hundred billion kWh. From just lacking power supply, the situation had developed to where complete electrical grids and sets of communication equipment were lacking.

Coal: From 1983 to 1985, there was a large nationwide increase in coal production. Following this, there were 3 years where the coal supply situation across the country was quite relaxed. Thus everyone thought that the coal problem, which had bedeviled us for many years, had been resolved. Like after a good harvest of grain or cotton, when some people say: "If there is more grain, what will we do?" or "If there is more cotton, what will we do?," some comrades also sighed: "If there is more coal, what will we do?" Some even said: "The coal problem is mainly a problem of railways. In the future, it will be sufficient just to build railways." In 1988, not long before the tight coal situation re-emerged, a responsible comrade still said. We have much coal. We need to concentrate on electrical power construction. The result of all this optimism was that the situation of much coal changed into one where coal was in short supply.

The blind optimism of energy situation appraisals has also been reflected in the formulation of national economic plans. If we take coal production as an example, under the Seventh 5-Year Plan, the goal for coal output in 1990 was 1 billion tons, only 130 million tons up on the figure at the close of the Sixth 5-Year Plan in 1985. This only required an annual average increase of 26 million tons. But the plan also stipulated an additional 8 million kW of thermal power installed capacity and an additional 2.5 million tons of steel per year. Calculating on the basis that each million kW of thermal power generating capacity requires at least 3 million tons of coal annually, 8 million kW would need 24 million tons of coal. Also, calculating on the basis that the smelting of 1 million tons of steel requires 2 million tons of coal, there is no way that 1.5 million tons of the planned increase could be met. And where was coal to be obtained for chemical fertilizer production, construction material, and the people's livelihood needs? The plan obviously did not consider this. It was only in spring 1989, after the overall tightness in coal supply appeared, that relevant departments decided that the goal of 1 billion tons of coal output should be brought forward and completed in 1989.

The Sixth Cause: The "Slanting" Has Come to Naught

Energy and transportation are weak links in the national economy and it is necessary to implement "slanted" investment for them. This was stated at the 12th party congress and has also been stated every year since. However, it must be recognized that the implementation of this policy has not been carried out well and it can be said that it has come to naught.

The head of an energy office in the State Planning Commission has said that, subjectively, we still consciously slant investment toward the energy industry and that from the First 5-Year Plan to the Seventh 5-Year Plan, state investment in energy has consistently been 20 percent of total investment. The problem is that the situation has changed and the investment "cake" has been reduced in size. Thus maintaining the 20 percent is no longer sufficient.

In the past, investment was entirely controlled by the state and 20 percent of investment was truly one-fifth of total investment. Now, the situation is different. Since the reforms and opening up began, following the increase in investment channels, a "three-thirds system" [san san zhi 0005 0005 0455] has been initially formed. The entire investment within the budget controlled by the State Planning Commission constitutes one-third and this annually totals 100 to 120 billion yuan. The non-budgetary investment controlled by both localities and by enterprises comprises one-third each and investment by each is about 100 billion yuan annually. There is in addition, quite an amount of foreign investment which wants to "eat up" domestic energy. Thus, although in the Seventh 5-Year Plan drawn up by the state, energy investment still constitutes 20 percent of the total, the actual investment in energy as a proportion of fixed assets investment throughout the society has greatly declined. This has formed an investment situation where this "cake" has become progressively smaller and the other "cakes" have become progressively bigger.

Further, seen in terms of implementation, the situation of the small "cake" is not ideal. During the Sixth 5-Year Plan, according to the plan, investment in energy should have constituted 21 percent of investment. However, in implementation, the actual investment only totaled 18 percent. During the Seventh 5-Year Plan, the planned figure was 20 percent, while it is estimated that the maximum completed will only be 18 percent. As far as the big "cake" is concerned, although there has been investment in the energy industry, it has seen reduction

to a miserable level. In 1988, the state implemented the method of raising funds for the development of electricity by having enterprises pay 2 fen for every kWh of electricity they used. In 2 years, a total of 8 billion-plus yuan was thereby raised. The oil industry has implemented all-round investment-output contracts for 9 years, and the total amount of funds used on exploration and development has been 30 billion-plus yuan, less than 4 billion yuan per year. Having localities and enterprises investing in and running mines began with the Sixth 5-Year Plan. The amount which has been gained thereby is only 2-3 billion yuan annually. It can be seen from the above that the little bit which localities and enterprises invest in energy is but 5 percent of their total investment "cake" of 200 billion yuan.

According to this rough calculation, the funds invested in the energy industry by our country every year only constituted 11 percent of total investment in fixed assets throughout the society. As compared to the original 20 percent requirement, this clearly cannot be considered "slanting" investment.

The reduction in investment, together with the price rise factors have resulted in the following situation in national unified-distribution coal mines: In the 4 years from 1986 to 1989, during the Seventh 5-Year Plan, the capacity of mines on which construction had begun was 80 million tons less than the plans, while the capacity of mines which had been put into production was more than 45 million tons less than the plans. Only 40.1 percent of the planned commencement of mines has been realized, while only 65.7 percent of the plans for putting mines into production had been realized.

At present, the establishment of a large or medium-size mine in our country requires about 7 years. If we add the period necessary to bring it into full production, the period involved is 10 years. Thus, if we also consider the mines which are being phased out or closed down, having passed their service period, it means that after the current "critical" period for coal production, in the latter part of the Ninth 5-Year Plan in the 1990's, there will essentially be no new mines to put into production and, during the Ninth 5-Year Plan, a "fault-line" will appear in coal development.

Countermeasures: Dealing With the Problems in a Comprehensive Way

As we enter the 1990's and look back on the road we took in the 1980's, look forward to the great goals of achieving a second doubling of GNP by the year 2000, and face the challenges of the 21st century, how should China's energy be developed?

In this respect, the Ministry of Energy has put forward energy development plans for our country for the year 2000.

Calculated on the basis of gross value of industrial and agricultural output growing at 6 percent annually, and considering the possibility of technological progress, the total primary energy needs of national economic development will be 1.4 billion tons of standard coal. Of this, raw coal output will constitute 1.4 billion tons, crude oil 200 million tons, natural gas 30 billion cubic meters, hydroelectricity 90 million tons of standard coal, and nuclear energy 12 million tons of standard coal. Of secondary energy: electricity demand will be 120 million kWh.

However, some data provided by the Ministry of Energy show that by the year 2000, even if we realize the above-mentioned goals, at that time the per-capita level of consumption of energy and electricity in our country will still be very low, and energy supply will still be very tight. This is because, at that time, the population of our country will have reached 1.2 billion and the amount of primary energy which can be consumed per capita will only be a little more than 1 ton of standard coal annually. This is equivalent to about 60 percent of the present world level.

Even despite these low levels, experts attending the national energy work conference held in Beijing in January 1990 held that, seen from the road already taken, it will not be an easy job realizing the above-mentioned tasks. Thus, we need strong and powerful development measures. Otherwise, there is a danger that these goals will not be met. Therefore they put forward the following proposed measures:

The first measure: When considering economic growth, it is first necessary to fix the speed of growth of energy and the possibility of energy supply. Calculating on the basis of the supply of primary energy being 1.4 billion tons of standard coal in the year 2000, the average growth rate for the next 10 years will be 3.5 percent. If we use a figure of 0.5 percent for the elasticity coefficient, the maximum speed of growth of industrial and agricultural output value can only be 7 percent, while the speed of growth of electricity should be in excess of 7 percent. Thus, in making arrangements for the national economy in the future, the growth rates for energy and the overall economy may have to be a bit slower. However, practice has proven that this will give us appropriate, balanced, and sustained development. Such development, regardless of which angle it is seen from, is better than "high speed" blind development which leads to structural dislocation and eventually requires readjustment.

At present, we should take the beneficial opportunity afforded by economic improvement and rectification and, in accordance with the level at which energy can grow, firmly cut back the scale of investment in fixed assets, readjust the industrial structure and the energy structure, and also readjust the disproportionate speed of industrial development.

The second measure: Readjustment of policies so that funds are organized and flow rationally and funds investment in the energy industry is guaranteed.

Over the last few years, why have our energy, transport, and other basic industries not been as vibrant as the

manufacturing industries, and have become weaker and weaker, while the manufacturing industries have become stronger and stronger? This relates to factors such as the huge investment required in energy construction, the long construction period, and the 8-to-10-year period before benefits can be gained, while the manufacturing industry requires little investment, results are seen quickly, and profits are easily obtained. The situation has also been prompted by the fact that since the reforms were implemented, the central and local authorities have instituted a system of "separate kitchens" in financial matters, and the governments have implemented contracts with enterprises.

In the past, regardless whether investment by localities or enterprises realized profits or losses, the state took responsibility for everything. Now, profits or losses affect the financial income of localities, the profits of enterprises, and individual interests. Comparing the before and after situations, we can say that the implementation of the "separate kitchens" arrangement in financial matters and the implementation of profit contracts in enterprises were certainly major steps forward. However, these meant decentralization and thus those who wanted to invest in energy had no way to take on the projects alone. Meanwhile, the state, as it was without funds, could not take on the construction of energy projects needed for economic development. This is a major reason why the energy projects planned for construction by the state in recent years have on many occasions not been implemented on schedule.

Thus, it is necessary to implement "slanted" investment for the energy industry and allow it to gain some momentum. In response to the new financial situation which has appeared since the reforms, the state should formulate corresponding policies to encourage the rational organization and flow of capital construction investment.

The third measure: During the "short-sightedness" and "short-term activities," where the various levels of decisionmakers are over-anxious for short-term benefits, and thereby guarantee funds for investing in the energy industry.

The vice governor of a coal-producing province, when talking about investment in energy, said: If I had money in my hands, I would prefer to invest it in tobacco rather than in coal. With tobacco, the investment can be recouped in 2 years and in 3 years one is making profits. If we build a mine, even disregarding the losses involved, by the time it is completed, I will be out of office.

A factory manager, when talking about investment in energy-saving projects, said: I am in my post for only 4 years. When the benefits of technical transformation are seen, I will probably have left the post. If there is money for technical transformation, it is better to give it out as bonuses, and then all are happy.

This shows that the slow situation in energy construction is related to the limited tenure of officials in government and factory managers and directors. They all prefer to adopt measures which "bring quick success and instant profits" during their period of tenure, so as to please people. Thus, if energy investment is to be guaranteed, work to overcome the "short-term activities" of decisionmakers at all levels is indispensable. If these "short-term activities" are to be cured well, it is necessary to move from where one or two people make decisions toward a situation where decisionmaking is more scientific and democratic.

The fourth measure: There is a need to tap potential and achieve results in the areas of management and technological progress.

Since the beginning of the reforms and opening up, there has been improvement to differing degrees both in enterprise management and labor productivity in the energy industry. However, it must also be recognized that, in the area of management and scientific and technological progress, when one looks at our energy industry in comparison to those in advanced countries, or compares advanced enterprises with backward enterprises in particular sectors of our energy industry, we see that there is quite great untapped potential in terms of labor productivity, consumption of materials, construction periods, and so on. The targets in some industries are not even at their historically highest levels. Take for example the "state contingents" in the coal industry. The average per-capita output by staff and workers in the unified-distribution coal mines is 1.14 tons. However, the highest figure is in the Jincheng Mining Bureau in Shanxi with a figure of 4.72 tons, while the figures for 30 percent of the mining bureaus are below 1 ton. The average efficiencies in major coal-mining countries abroad are all above 3 tons. In the pit mines of the United States, the figure is 16.28 tons, while for open-cut mines it is 40 tons. The average annual output of coal by comprehensive extraction contingents in China's unified-distribution coal mines is 520,000 tons, and the lowest is about 200,000 tons. This is below the output of the top-grade ordinary extraction contingents. Abroad the figures are generally well above 1 million tons. In the electricity industry, for thermal power plants producing 1 million kW, our country employs about 1,500 people. Also, we can compare the advanced Dalian power plant which produces 700,000 kW and employs 500 people, with the Matsushima power plant in Japan, which is basically the same, but employs less than 300 people. The average coal consumption per kWh of electricity produced by thermal generating units of 6,000 kW and above in our country is 431 grams, while in the Soviet Union the figure is 320 grams.

In the current economic improvement and rectification, the energy industry has been listed by the state as an industry to be greatly strengthened and to see priority development. It is thus necessary for the state to increase investment. Without money, mines, electricity plants, and oil fields cannot be built. However, it must also be recognized that the state is still quite poor and at present and for some time in the future, the various levels of

leadership should put their greatest efforts into strengthening management and strengthening technological progress. They should manage their operations well, properly use the funds, equipment, labor, and materials they have at present and fully tap the latent potential within the energy industry and within their enterprise, so as to raise labor productivity.

The fifth measure: Energy products should be seen as commodities, and the situation where the value of energy products is seriously divorced from their prices should be gradually turned around.

Of the many industrial systems in China at present, there is none which faces operational difficulties of the scale faced by the energy industry: The coal industry is experiencing industry-wide debt, the oil industry is experiencing industry-wide debt, while the electricity industry is seeing small profits, but is gradually sliding toward the fringes of industry-wide debt. A situation such as this is rarely seen anywhere in the world.

Seen on the surface, the losses which have occurred in the energy industry have been produced by the increased amount of work and materials which have had to be invested. In fact, the losses are due to the fact that price is divorced from value. Take for example the Huainan coal mine in Anhui, where coal extraction costs are not too high. At present, the cost of extracting 1 ton of coal is 41 yuan. However, the price fixed by the state is only 36 yuan. For every additional ton of coal produced, the enterprise goes 5 yuan further into debt. As another example, we can take the Liaohe oil field which ranks third in the nation in terms of oil production capacity. In 1989, the cost of producing 1 ton of oil was 161.05 yuan, while the state-stipulated price was 137 yuan. For each additional ton of oil produced, the enterprise had to suffer a loss of at least 24 yuan.

At present, in the international market, 1 ton of raw coal is priced at about $50, while 1 ton of crude oil (calculated on the basis that 7.5 barrels constitute a ton) is priced at $150. Converted to renminbi, these prices are 230-plus yuan and 700-plus yuan, respectively five times and four times higher than the domestic prices. Even calculated on the basis of 167 yuan, which includes the additional 30 yuan per ton being added to the price of each ton of crude oil this year, the international price is still over three times higher.

Cheap energy has played a promotional role in the development of our manufacturing industry and in improving the people's standard of living. However, the harm this brings to national economic development cannot be ignored. On the one hand, this results in the energy industry being unable to form a "blood-making" mechanism for self-development and self-transformation, and affects the enthusiasm of staff and workers for improving efficiency and increasing the production of energy. On the other hand, it is difficult to create in the society a respect for the labor of staff and workers in the energy industry and stimulus to conserve energy. Thus, there must be a readjustment of energy product prices in accordance with their value. In the current situation, national strengths will not allow overall readjustment of prices. We should first, in new electricity, coal, and oil projects, set prices at a level which guarantees that the projects can repay the credit and interest. At the same time, in accordance with the current situation where the load on the energy enterprises is too heavy, we should appropriately lower their tax rates and reduce the number of taxes to which they are subject.

The sixth measure: Readjusting the internal structure of industry. With coal as the base and while continuing to develop thermal electricity, we should greatly develop hydroelectricity and positively develop the nuclear industry.

Coal is the basic energy resource in China and our coal reserves are relatively rich. In comparison, our oil and natural gas resources are smaller. Thus, for quite a period to come, we should base ourselves on coal and speed the development of coal. In this way, not only will we be able to satisfy domestic needs, but we will also be able to speed energy development by earning foreign exchange through exports.

On the basis of the goal to double the output of electricity generated by the year 2000, at that time, the capacity of our country's electricity generating units will have to be increased from the current 120 million kW to 240 million kW. At present, the nuclear industry has just commenced in our country and, by the year 2000, the maximum nuclear power generation will only be 600 to 1,000 kW. The proportion it constitutes in the total will not be very great. The national situation also determines that we must use the majority of our oil as industrial raw material, and this in turn determines that our electricity generation must remain dependent on thermal generation and hydroelectricity. Thermal generation mainly means burning coal. In the year 2000, when our coal output reaches 1.4 billion tons, 400 million tons up on the present figure, if we can take one-quarter to generate electricity, electricity generation installed capacity can only increase 30 to 40 million kW. If we can take half to generate electricity, the installed capacity can only increase by 70 million kW. If we calculate on the basis of a 120 million kW increase, then apart from nuclear energy and at least 4,000 kW of hydroelectricity, this is equivalent to a necessary annual increase of 4 million kW. In the latter part of the Seventh 5-Year Plan, the proportion of hydroelectricity in overall electricity construction is reduced. The period of construction for hydroelectricity projects is long and thus we must begin grasping hydroelectric construction now.

The coastal regions are the economically developed regions of our country. However, they lack coal resources and also lack large rivers on which hydroelectric stations can be built. In order to reduce the problem of transporting coal in the year 2000 and in order to resolve the

problem of lack of conditions to develop hydroelectricity, the state should speed the pace of nuclear energy construction in these areas. Otherwise, it will be quite difficult to achieve the goal of 600 to 1,000 kW of nuclear electricity installed capacity by the year 2000.

The seventh measure: Combining the grasping of railway construction and the grasping of industrial structural readjustment between regions. After the recurrence of tightness in coal supply throughout the country in the latter half of 1988, some people discovered that, as many coal-producing areas lacked transport, they had no way to transport their coal. Some had no option but to stop production for this reason. According to statistics, in that year, because of transport restrictions, there was a reduced production of over 10 million tons of coal just in the provinces of Shaanxi, Shanxi, Henan, Ningxia, and Inner Mongolia.

This situation shows that our country's railway construction is not keeping pace with the country's economic development, and also shows the lack of coincidence between the regional industrial structure and the natural spread of energy and raw materials in our country.

On the one hand, nine-tenths of the taxes are paid by the areas in the southeast. On the other hand, there is a great lack of energy and raw materials in the eastern coastal regions. According to a survey by relevant state departments, 70 percent of our country's hydroelectricity resources lie in the southwest, 60 percent of coal resources lie in north China, while the hydroelectricity and coal resources in the coastal and northeast regions, which produce 73 percent of gross industrial output of the country, constitute only 10 percent of the total.

This raises two problems for us. If the current economic structure does not change, and by the year 2000 industrial and agricultural gross output value doubles again on the current basis, the volume of coal transport required will be equivalent to 90 percent of the current annual national rail transport volume. Even if we start putting great efforts into railway construction, and double the length of rail open to traffic, the tight situation will remain like today and there will be no real improvement.

At present, the only provinces which send coal outside their provincial borders are Shanxi, Shaanxi, Inner Mongolia, and Henan. Of these, Henan now sends very little outside the province. In the year 2000, everyone will be buying coal from Shanxi, Shaanxi, and Inner Mongolia. However, as to whether they will be able to transport the coal, on the economic level there has not been overall consideration.

Thus, we need to start now in order to resolve this difficulty. At the same time as grasping railway construction, we need, in accordance with resource deployment, to grasp the readjustment of the industrial structure between regions. The coastal regions with their large populations, little land, few resources, and quite major technological strengths should orient themselves both to the international and domestic markets. Their key focus should be on developing technology-intensive industries which require little energy and few raw materials and which have high economic results. The hinterland areas, with their rich resources, wide areas, and small populations should stress production of energy and raw materials, as well as the heavy industrial and chemical industries and production of consumer products.

The eighth measure: In conserving energy, there must be a sense of urgency which brooks no delay, and this task must be grasped realistically.

According to the energy development plans for the year 2000 formulated by the Ministry of Energy, at that time, the national primary energy output will be 1.4 billion tons of standard coal. If we are to achieve this goal, we need to make efforts on all levels. However, calculated on the present national per-unit consumption of electricity, by the year 2000, the total national energy needs will be 2.3 billion tons of standard coal.

The 2.3-billion-ton demand and the 1.4-billion-ton supply will leave a huge shortfall of 900 million tons. This means that if we are to achieve the economic development targets of the year 2000, a major precondition is the reduction of energy consumption.

The need to conserve energy was put forward back in 1981. Thus, in the next 10 years, in grasping the conserving of energy, not only must we make calls, but must also take action. Not only must enterprises which use energy grasp economy measures, but those enterprises which produce energy must also engage in conserving energy. Conserving energy not only requires technological progress, but also dealing properly with the commonly seen energy waste. There must be economic measures as well as administrative measures implemented.

At present, why are enterprises not interested in saving energy? The key lies in the fact that the price of energy is too low. Thus when an enterprise obtains credit from a bank to carry out energy-saving transformation, the benefits they achieve from the transformation are insufficient to pay the interest on the credit. Seen from this angle, putting energy prices in order and changing the situation where the price of energy is divorced from its value is a necessary measure in improving the energy supply situation.

It needs to be pointed out that if we are to implement the above-mentioned measures, we cannot just institute individual measures. They have to be implemented together. In implementing these measures, the difficulties are very great: The speed of economic growth must be reduced; the social contradiction arising from this must be controlled at the lowest possible level; many new spheres will require great efforts to open up...

However, the road we have taken and future goals tell us that we have no other choice.

Construction of 16 Power Projects Approved

OW0206212490 Beijing XINHUA in English 1432 GMT 2 Jun 90

[Text] Beijing, June 2 (XINHUA)—The State Council has approved the construction of 16 large- and medium-sized electric power projects which will increase China's total generating capacity by 5.9 million kilowatts, according to officials from the State Energy Investment Company.

Most of the 9.3 billion-yuan cost of the projects will be borne by local governments. State investment will account for only one- third of the total.

Half of the projects involve expansion of existing power plants.

Zhejiang Moves Ahead in Development of Power Plants

40100063B Beijing CHINA DAILY (Provinces Information) in English 18 Jun 90 p 4

[Article by staff reporter Da Li: "Zhejiang To Put the Power Into Eastern China"]

[Text] The eastern coastal province of Zhejiang is surging ahead in its development of power plants.

The third phase of its Zhenhai Power Plant—two sets of generators with a total capacity of 400,000 kilowatts—recently went into operation to turn out about 2.6 billion kilowatt hours of electricity a year for the province, which "under normal circumstances" is short of 2 billion kilowatt hours annually, according to officials from the Electric Power Bureau of Zhejiang Province.

With the newly added capacity, the Zhenhai plant near the port city of Ningbo is now the largest thermal power plant in Zhejiang, one of the three 1-million-kilowatts-strong power plants in the East China power grid.

The increased output of 2.6 billion kilowatt hours a year will be all for the use of Zhejiang Province because the province raised funds itself for the third phase of the extension of the Zhenhai plant, which as a national power project is connected with the big regional power grid, according to Yuan Zhannan, deputy chief of the provincial power bureau's planning department.

But the increased supply of power does not mean a surplus of or sufficient decrease in Zhejiang power shortages, Yuan said. The senior engineer explained that while big and advanced generators are being built and put into use, many small thermal generators are being eliminated "because they are a great waste of fuel, consuming three times more coal or diesel than the big and advanced generating units for the same amount of electricity generated."

The nation's past modern and largest generating set in Beilun Power Plant in Ningbo City is now being readjusted after the installation of this set with a generating capacity of 600,000 kilowatts was completed at the end of last month.

"By developing, we plainly mean modernizing generators of high efficiency," she said.

This first generating unit of the Beilun plant is expected to go into operation and be connected with the East China power grid by the end of this year, according to Fan Qun, an official from the provincial power bureau's capital construction department.

Fan said that the State had recently approved the construction of Zhejiang's Shangxin Power Plant, whose first phase includes two 125,000 kilowatt generating sets with one scheduled to produce electricity by the end of next year.

Fan said the Wenzhou Power Plant, whose first phase also includes two 125,000 kilowatt generating sets, is scheduled to supply power for the port city of Wenzhou later this year.

Meanwhile, he said, plans and feasibility studies are being made for construction of power plants in Xiaoshan City and Jiaxing City.

"Our capital construction department will be very busy in the days to come," the official said.

According to Yuan, by the end of the Eighth Five Year Plan (1990-1995) Zhejiang will have a total generating capacity of more than 8 million kilowatts compared with last year's 5.6 million kilowatt hours.

The coming development is partly grounded on the fact that after the year 2000 there will be few vacant places for construction of large industrial enterprises in East China except for Zhejiang Province's coastal areas, according to Fan.

"It is possible that Zhejiang will become the base of power supply for East China," he said.

Counties Focus on Building Small, Independent Power Nets

906B0060A Beijing RENMIN RIBAO in Chinese 29 Jan 90 p 2

[Article by Zhang Xuejian [1728 1331 0313]: More Than 800 Counties Establish Small-Scale Hydropower Supply Nets That Are Built, Managed, and Utilized Locally"]

[Text] After many years of developing rich resources of hydroelectricity, building power stations and regional electricity networks, China has essentially solved the problem of providing electricity to outlying areas not covered by large-scale grids. Today, more than half of China's counties have developed and utilized local small-scale hydropower resources. Among these are more than 800 counties that have formed "oases" of regional power networks supplied mainly by hydroelectricity.

According to surveys, there are 76 million kilowatts of hydroelectricity resources that can be developed in China. If all of this is utilized, the scale of production will approximately equal 20 Gezhouba hydropower stations (250 billion kilowatt-hours annually). At the end of 1989, China had finished more than 60,000 small-scale hydroelectric stations for a total installed capacity of 12.37 million kilowatts and an annual output of 34.3 billion kilowatt-hours. This represents more than one-third of China's use of electricity in agriculture.

In order to improve the standard of more than 800 county level hydroelectric regions, China decided in 1983 to begin to establish pilot project counties to use electricity in agriculture. Of the first group of 100 pilot counties, 88 had been examined and accepted by the government by this January. In these counties, the per capita average use of electricity has risen from a mere 100 kilowatt-hours to more than 200 kilowatt-hours; more than 90 percent of the agricultural population has electricity. Before the experiment, production in these counties averaged only 30 percent of the total production of all counties' industrial and agricultural output. Now it has risen to more than 50 percent. The net per capita income has risen from 199 yuan to more than 500 yuan.

According to sources, there are some problems with the small-scale hydroelectricity supply regions. The main weakness lies in deficiencies in the sources of electricity and the quality of the electricity produced. In order to improve the situation, many provinces, municipalities, and autonomous regions have decided to pool capital and material resources and combine the regulatory system of rivers. This is an effort—in addition to developing the small-scale electricity networks—to begin to design a number of medium-sized hydroelectricity stations as the backbone of the small-scale hydroelectricity networks. The Ministry of Water Resources plans to complete 100 medium-sized hydropower stations by the end of this century. The total installed capacity will be 4 million kilowatts. The completion of these stations will figure importantly in the improvement of the power supply.

Big Yantan Project 1 Year Ahead of Schedule

906B0060B Beijing RENMIN RIBAO in Chinese 24 Mar 90 p 1

[Article by Zheng Shengfeng [6774 4141 0023]: "Changes in Construction Strategies in Key Project Produces Results: Yantan Station Construction Proceeding 1 Year Ahead of Schedule"]

[Excerpt] Nanning, 23 March—A key national project, Guangxi's Yantan hydroelectric station has achieved a number of breakthroughs and records as a result of 3 years of hard work by thousands of project personnel.

High speed. Since the blocking of the river a year ahead of schedule in November 1987, the project has maintained pace and is still 1 year ahead of schedule.

High quality. Projects that have already been examined and accepted have all reached standards of excellence. These include station and dam excavation, pouring of concrete for the channels, and the installation of large steel conduits—a total of five main projects. The level of excellence exceeds the code by 10 percent.

High benefits. In a tough economic situation which existed until the end of 1989, the savings in investment reached 100 million yuan. This represents the use of 6 years' worth of budgeted investment for 7 years' worth of construction.

Low waste. The waste in the main dam's construction is only 63 percent of the regulation waste amount. Up to now, 169,000 tons of concrete, 100,000 tons of timber, and 55 million tons of steel have been saved.

The Yantan hydroelectric station is located on the midstream of the Hongshui He in Guangxi Province and is known as a gold mine for hydroelectric power. It is the key station among the 10 Hongshui He stations. The Daba station has a planned height of 111 meters. The total installed capacity is 1.21 million kilowatts. It is among the few giant hydroelectric power plants in China. The station will take 12 years to build at a cost of approximately 1.632 billion yuan. After completion, the station will figure heavily in the development of China's key aluminum base nearby as well as in the regulation and improvement of the electricity supply for south China. Now that construction is ahead of schedule by 1 year, the savings in interest will reach 50 million yuan. The amount of electricity generated will increase by 5.4 billion kilowatt-hours. The increased industrial and agricultural production value will be 14 billion yuan; and the taxes generated will be 250 million yuan.

This hydropower station is the first test site among China's large-scale hydroelectric stations to reform its construction and management system. The Yantan Hydroelectric Station Engineering Construction Firm that was formed to implement such reforms as contracts with the government covering investment, length of project, quality, waste, and safety. In turn, the firm opened the major engineering projects to the general public. [passage omitted]

Lubuge Adds Third 150-Megawatt Unit

40100062 Beijing CHINA DAILY (Business Weekly) in English 4 Jun 90 p 2

[Text] The third generating unit of the Lubuge Hydroelectric Power Station went into regular operation last week after 72 hours of trial operation. The power station, located on the Huangni River on the border between Yunnan and Guizhou provinces, is China's first hydroelectric power station built with foreign funds. Construction of the project was through international competitive bidding. It has four 150,000-kilowatt generating units with a total capacity of 600,000 kilowatts. The first two units went into operation in 1988 and 1989, respectively. They have produced 1.6-billion-kilowatt hours of electricity so far. The fourth generator is being installed and is expected to go on stream in the first quarter of next year.

Volume of Coal Mine Meeting Basic Needs—Transportation Remains Bottleneck

906B0061C Shanghai JIEFANG RIBAO in Chinese 31 Jan 90 p 5

[Article by JIEFANG RIBAO reporter Shi Zhixing [2457 1807 5281]: "Good News and Bad News From the National Coal Ordering Conference: Volume of Coal Output Basically Meeting Needs, Shortages of Coal Varieties and Transport Capacity Still Acute—All Areas Implement Four Unifications in Coal Ordering, Over-Quota Coal Output Must Serve State Directional Allocation"]

[Text] I learned from the National Coal Ordering Conference that coal output in China surpassed the benchmark 1 billion tons level in 1989 and that a substantial increase in coal output is planned for 1990 compared to 1989. Orders from all provinces and municipalities and all industries indicate that coal output will basically meet demand. However, there are still extremely acute contradictions among coal varieties, regions, and transport capacity.

In accordance with State Council requests, the 1990 Coal Ordering Conference implemented four unifications in unified distribution coal mines and unified allocation local coal mines. This refers to unified allocation, unified ordering, unified transport, and unified dispatching. The state has exclusive selling rights over whatever amount is produced by all coal mines, whether at unified distribution coal mines or local coal mines. Over-quota output can be sold at preferential prices but the trend must conform to state allocation. The main ordering and transport plans at this ordering conference implemented directive, guidance, and directional plans for coal as well as some coal which will be re-ordered after future implementation of transport plans. In Shanghai, for instance, coal demand for local industries and household purposes (including coal for generating power) was 25.25 million tons. This ordering conference basically implemented 22 million tons, so ordering will be implemented later for the additional 3 million-plus tons of directional coal.

This ordering conference first of all guaranteed the needs of key industries. The first guarantee for power, the second for agricultural materials, the third for metallurgy and household use, and so on were basically met. A small amount of compensation was made for coal supplies in several provinces, autonomous regions, and municipalities, and they were linked to a balance in the transport of resource varieties. Coal for power generation concerns industries and people's lives all over China, so full play should be given to the role of large and medium-sized enterprises which have extremely important effects on the national economy. Power is the key, so the state is trying to guarantee coal requirements of both ministry and provincial power plants. There was a 5 million ton increase at this ordering conference compared with the original program. Because of resource and transport capacity restrictions, the principle of obtaining supplies locally is still being applied for power plant coal supplies to give full play to the important role of power plants in industrial and agricultural production.

The contradiction between supply and demand for coal in 1990 is manifested mainly in many coal sources but inadequate transport capacity, sufficient quantities but shortages of product varieties, and regional imbalances, small coal output, and inadequate reserves. The east and north China regions, which urgently need coal, saw a decline in output of unified distribution coal and shortages of product varieties in 1990. Moreover, the proportion of orders for high quality power coal has declined, from 30 percent to 20 percent in Shanghai, for example. With the addition of directional coal at the maximum allowed prices in different regions, local areas have been forced to make greater financial outlays, but overall coal prices are lower than in 1989. Supplies of power coal are also inadequate, so state plans for 1990 have decided to increase the amount of coal transported by 20 million tons over 1989 plans, but this ordering conference already exceeded plan arrangements by a factor of more than one (including coal haulage within coal producing provinces), which has increased pressures on railroad departments. At present, restricted railway capacity has made it impossible to ship more than 2 million tons of coal in northeast China, Guizhou, Ningxia, Inner Mongolia, and other regions. Ministry of Railways departments will exploit internal potential to increase transport amounts and transport coal to users.

Shandong Unified Distribution Mines Aim for 60 Million Tons in 1990

906B0061B Jinan DAZHONG RIBAO in Chinese 11 Feb 90 p 1

[Article by DAZHONG RIBAO reporters: "1989: The Coal Industry Reports All-Round Victory, 1990: Striving To Surpass 60 Million Tons—Shandong Province Unified Distribution Coal Mine Work Conference Calls on Cadres and Employees To Be Bold in Taking on a Heavy Burden"]

[Text] The Shandong Province Unified Distribution Coal Mine Work Conference which concluded on 9 February 1990 at Zibo called for inspiring enthusiasm and advancing despite difficulties to produce more coal and guarantee sustained, stable, and coordinated development of Shandong Province's economy.

Shandong Province's coal industry reported an all-round victory in 1989. Total coal output was 59.283 million tons, up 6.6 percent over 1988. Output in unified distribution coal mines was 40.913 million tons, up 4.79 percent over 1988. Unified distribution coal mines invested a total of 698 million yuan in capital construction, up 21 percent from 1988. They completed five mines at Jiangzhuang, Yangcun, Nanding, Dongtan, and Tianchen, adding 7.75 million tons in production capacity, the largest scale of mines placed into operation in history. Safe production held the death rate to under

1 per 1 million tons for 2 consecutive years, making it China's leader in provincial-level unified distribution coal mines.

The conference decided that on a foundation of ensuring completion of production plans of 39.38 million tons in Shandong Province's unified distribution coal mines during 1990, they would strive for 42 million tons. All of Shandong's coal mines should try to surpass 60 million tons in raw coal output and strive to complete 700 million yuan in capital construction to increase reserve strengths in coal production. To achieve these goals of struggle, the conference proposed concrete requirements for work during 1990: 1) Actively and stably carry out administrative rectification and enterprise reform well, straighten out the proportional relationship between extraction and excavation, readjust internal structures, and solve the problem of low economic results. 2) Conscientiously focus on safety work, ensure that the death rate is stabilized at less than 1 per 1 million tons, and strive for even better levels. 3) Resolutely focus on the "double increase and double economy" movement, expend over 90 percent of our efforts on exploiting internal potential, try in every possible way to increase labor productivity and economic results, and increase full-staff labor productivity by 0.05 tons/manshift compared to 1989.

Shandong Provincial Vice Governor Li Chunting [2621 2404 0080] spoke at the unified distribution coal mine work conference. He expressed his hope that all employees on the coal battlefront will conscientiously summarize experiences, work ceaselessly and unremittingly, work posthaste, sustain stable and high output, and fight for new victories.

Inner Mongolia: China's Future Coal Base

906B0061A Beijing LIAOWANG [OUTLOOK] in Chinese No 13, 26 Mar 90 pp 10-11

[Article by Cui Zhenye [1508 2182 2814]: "Inner Mongolia, China's Coal Base Area of Tomorrow"]

[Text] Construction of the first stage project at world-famous Jungar Coal Field will begin in a comprehensive way. It will enable construction of Dalad Power Plant, Asia's biggest thermal power plant. The feasibility report has been discussed by experts in all areas. This shows that Inner Mongolia will become China's main coal base area in the 21st century.

I. Magnificent Plans

China's energy resource industry faces difficult tasks and serious situations in the 1990's, so we must move up one stage.

A comprehensive start on construction of the first stage project at Jungar Coal Field is an important step in China's strategic shift to west China in developing coal. It is also the biggest development project in mainland China's coal industry in 40 years. The total investment will be 4 billion yuan, larger than the Sino-American joint venture Pingshuo Antaibao Strip Mine. This project mainly includes Heidaigou Strip Mine with yearly output of 12 million tons of raw coal, a coal dressing plant with a similar capacity, a pit-mouth power plant with an installed generating capacity of 200 MW, and a single-line electrified railway with a direct line length of 215 kilometers. The project as a whole will produce coal, generate power, and be opened to traffic in early 1993. The strip mine will cover an area of 42 square kilometers and can extract raw coal reserves of almost 1.5 billion tons. Its service life is 115 years. Its stripping and excavation equipment and technologies are at advanced international levels, including compact large bucket wheel excavators and 154-ton dump trucks being used in China for the first time. This dedicated coal railway connects with Beijing-Baotou Railroad and Datong-Shaanxi Railroad, giving it a long-distance transport capacity of 40 million tons.

The two banks of the Huang He in west Inner Mongolia, called the "gold belt" by the China Loess Plateau Inspection Team, is one of the world's biggest energy treasure-houses. The region has a wide expanse of flat land covering a vast area. It has proven coal reserves of 170 billion tons. It has abundant water resources surpassing those in Shanxi and Shaanxi which can provide 30 billion tons of Huang He water and groundwater. Along the 780 kilometer-long Huang He, the state has decided to develop and build several large and medium-sized power plants around the coal base area. Preparatory work for power plants at Haibo Bay, Dongsheng, Daihai, Togtoh, and other sites is now being speeded up. Officials in the Ministry of Energy Resources revealed that preparations are now under way to build Dalad Power Plant at the north end of Shenfu Dasheng Coal Field, the largest of the world's seven biggest coal fields. The State Energy Resource Investment Company and Inner Mongolia Autonomous Region People's Government have discussed joint investments during the Eighth 5-Year Plan for first building 1,200 MW in electric power projects, then using generators with an installed generating capacity of 600 MW and larger, and eventually attaining an installed generating capacity of 5,000 MW.

To implement this plan, the Chinese government is now trying to find ways to deal with the problems of inadequate inputs in the energy resource industry. The state plans to invest more than 30 billion yuan over the next 10 years focused on helping Inner Mongolia develop coal, electric power, communications, and other basic industries. The investment in these key projects under consideration will be roughly equivalent to the total 40 billion yuan in industrial fixed capital built in Inner Mongolia over the past 40 years. When this time comes, or after working for a few more years, there is great hope that yearly raw coal output in Inner Mongolia will reach 200 million tons and that the thermal power installed generating capacity will surpass 20,000 MW.

II. Initial Scale

Inner Mongolia's energy resource industry did not begin to take off until China implemented the policy of reform and opening up in the 1980's.

When Inner Mongolia is mentioned, most people in China and foreign countries think of vast grasslands and the barren and frigid Gobi Desert which gives one a remote and quiet feeling. This feeling could also be seen in the lives of people in pastoral regions shortly after new China was founded. For generations, pastoralists of the Mongolian nationality depended on water and grass, "burned ox dung and lighted oil lamps, and moved their families about as they pleased." Although a "sea of coal" had already been discovered beneath the grasslands at that time, there was no energy resource industry at all. Production methods in small coal pits were backward, with the people using pickaxes. There was no safety to speak of. Moreover, the entire Inner Mongolia region had just eight independently operated small thermal power plants with a total installed generating capacity of 13.4 MW which produced 16.56 million kWh of power yearly. In 1978, the region's coal output was less than 20 million tons and the installed generating capacity was only 1,090 MW.

The past decade has been the golden age of major energy resource development in Inner Mongolia. During this period, the Inner Mongolia Autonomous Region took the path of coal construction as the foundation and electric power construction as the center. They reinforced petroleum exploration, made rational use of wind power, and achieved an energy resource transition.

First, coal production developed sufficiently. Over the past decade, the state invested in expanding and building coal mines that brought new life to Jalai Nor, Baorxil, Wuda, and many other old mines. This was particularly true of continued development of four large coal fields at Huolin He, Yimin He, Yuangao Shan, and Dasheng which revealed the start of a new era in Inner Mongolia's transition from resource advantages to economic advantages. From this, the region's coal industry doubled its output and a complete system took shape for geological prospecting, production and construction, scientific research and design, and other areas which created the conditions for even larger-scale development in the future.

News of even greater victories was reported in electric power construction. China's first 600 MW generator went into operation at Yuanbao Shan Power Plant and the first large thermal power plant on Inner Mongolia's soil with an installed generating capacity of almost 1,000 MW was built. A 500 kV ultrahigh voltage power transmission line crosses the region from east to west. Electric power construction sites can be seen everywhere, from the Hulun Bor grasslands to Ulanbu and the edge of the desert. Many medium-sized and small generators have been fired up at Hailar, Jalantun, Tongliao, Xilin Hot, Fengzhen, Baotou, Ula Shan, Uda, and other places. In 1989, Inner Mongolia added 550 MW in installed generating capacity, generated more than 15 billion kWh of power, and began transmitting large amounts of power to northeast and north China. Another 500 MW in generators will begin operating in 1990, and ground will be broken to begin construction at Yimin He and other large pit-mouth power plants. Many young pastoralists who used to carry candles across the huge coal deposits are laying down their whips and putting on work clothes to become the first "angels of light" in the Mongolian nationality.

Small oil lamps have burned in Mongolia for years, but elderly "eji" (the Mongolian word for mama) did not know what petroleum was. Now, however, Arxan Oil Field, located deep in the Xilin Gol grasslands, has formed a yearly production capacity of 1 million tons of crude oil and a 365-kilometer-long oil transmission pipeline has been turned over for use. The "oil dragon" is transported to the outside via Jining-Erlian Railway. The area has proven petroleum reserves of 100 million tons and prospective reserves of several 100 million tons.

Inner Mongolia is an area of China with abundant wind power resources. Preliminary estimates indicate that the region has total wind power reserves of about 300,000 MW, equal to one-fifth of China's total wind power reserves. Effective annual wind power reserves in the region west of Daxing'anling, north of the Yin Shan Range, and the Ordos Plateau exceed 600 kWh [as published]. Small wind power generators are becoming popular throughout the pastoral region.

III. Abundant Resources

Inner Mongolia Autonomous Region, which runs across northeast, north, and northwest China, has 8.6 million hectares of excellent pasture, the largest among China's five big pasture regions. It has 12 million hectares of luxuriant forests which include about one-half of China's virgin forest area. It has more than 120 varieties of minerals, most of them rare earth reserves, which account for more than 80 percent of global reserves. However, it is coal that truly makes people proud and which will truly play an important role in China's economic takeoff in the 21st century.

We can begin with the first-stage project at Jungar Coal Field. The initial extraction region is 7.86 kilometers long and 5.89 kilometers wide. Calculated at yearly raw coal output of 12 million tons, it will be sufficient for extraction for more than 100 years. Simply put, Heidaigou, located in the initial extraction region, is a mountain of coal whose coal seam outcrops exceed 30 meters in cross-section. Jungar Coal Field, which is centered on Heidaigou, has a vertical depth of more than 600 meters. Prospecting indicates that 26.2 billion tons of Carboniferous system coal lies buried under an area of loess covering 1,365 square kilometers. Moreover, it appears

that Jungar Coal Field is linked underground with the Dasheng coal deposit. Six coal deposits with reserves exceeding 10 billion tons have already been found in the region. Moreover, they are buried at shallow depths, the coal seams are thick, the extraction vs. removal ratio is small, and they are suitable for open-pit extraction. The region now has proven coal reserves of 217 billion tons and prospective reserves are projected to exceed 1 trillion tons, making it second only to China's biggest coal base area Shanxi.

Shengli Discovers New Oil-Gas Deposits

SK1306045390 Jinan Shandong Provincial Service in Mandarin 2200 GMT 25 May 90

[Text] The Shengli oil field recently discovered new oil and gas deposits in the Shaojia area in Hekou District of Dongying City northwest of the mouth of the Huang He. This is the first time that Shengli oil field has discovered such oil and gas layers. The oil field has, to date, ascertained deposits of 8 million tons of oil and 120 million cubic meters of natural gas.

Nuclear Power: China's Major Energy Supplement

906B0057A Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 26 Mar 90 p 3

[Article by RENMIN RIBAO reporter Liu Xieyang [0491 3610 7122]]

[Text] Actively developing nuclear power has become an important step in solving China's energy problems.

China is rather rich in total energy resource output but the amounts available per capita are small. In structural terms, coal accounts for an especially large proportion and hydropower resources are mainly concentrated in southwest China. China's economically developed eastern and coastal regions have extremely serious energy shortages and are distant from coal and hydropower base areas. Developing nuclear power is a very good way to solve these problems.

China's nuclear industry was established in the 1950's. After 30 years of hard work, we have built many types of nuclear reactors and accumulated valuable experience in safe management and operation. We now understand the technologies of uranium ore prospecting, extraction, refining and processing, fuel element manufacturing, fuel post-processing, and others. Our technical personnel have a full range of specialized knowledge and a basic capacity for research and design, and for manufacture of some instruments and equipment.

Qinshan Nuclear Power Plant in Zhejiang's Hangzhou Bay was studied, designed, and manufactured by China itself. Its completion is expected at the end of 1990. The power generation capacity of this nuclear power plant during the first stage will be 300 MW. Under guidance by the State Nuclear Safety Bureau, its safety design, earthquake resistance design, fire protection, flood and tide prevention, control protection, and other areas have been repeatedly inspected and conforms to requirements. After visiting Qinshan Nuclear Power Plant, International Atomic Energy Agency General Secretary Hans Brooks expressed his satisfaction with the great concern for quality and safety issues at this nuclear power plant.

Construction is now being speeded up at Guangdong's Daya Bay Plant, a nuclear power plant built through Chinese and foreign joint investments. The large spherical containment vessel for the nuclear plant reactor building has been erected and the concrete structure for the No 1 gas turbine building is complete. Work is fully under way on the No 2 gas turbine plant building project. This nuclear power plant will have two 900 MW generators. The first generator is expected to generate power in October 1992 and the second generator will produce power 9 months later. Foreign countries supplied all the equipment and designs for this large pressurized-water reactor nuclear power plant and it embodies advanced levels of the 1980's. Completion of these two nuclear power plants will reduce the electric power shortage in Zhejiang and Guangdong Provinces and they can accumulate practical experience for developing China's nuclear power industry.

There are many advantages to developing nuclear power, but certain conditions must be present and they must be based on actual conditions in a particular nation.

Nuclear power is investment intensive, technology intensive, and equipment intensive, and it involves long construction schedules. Estimates by relevant departments show that during the initial stages of nuclear power development in China, capital construction expenses for nuclear power will be about double those for thermal power.

Nuclear power involves complex technologies and strict demands. Besides the nuclear industry system, it also concerns the metallurgical, chemical, electronics, machinery, and many other systems and all S&T fields. A complex high technology process is involved all the way from uranium ore extraction and concentration to nuclear power plant construction and operation, as well as nuclear waste disposal. It requires close coordination, precision design, and careful construction.

China is a developing nation with very limited financial strengths, foreign exchange reserves, and technical levels. We must proceed from our strengths, actively develop, and steadily advance.

China's Ministry of Energy Resources has now formulated principles and plans for developing nuclear power. The overall requirements are to gain an understanding of nuclear power plant construction technologies as quickly as possible to create the conditions for even faster development of nuclear power after the year 2000. The main thing during this century is to grasp nuclear power project design, equipment manufacture, and power plant construction and operation technologies, and basically achieve Chinese-based production of 600 MW-grade nuclear power designs and equipment to lay a foundation for faster development in the early 21st century. Up to the end of this century, besides building the Qinshan first, second, and third stage projects, we also should prepare to build nuclear power plants in coastal regions which have energy shortages.

The tasks at present are to implement planning tasks and focus on building the two existing nuclear power plants and to use this to conscientiously absorb advanced Chinese and foreign experiences. Adhere to the principle of invigoration within China and opening up to the outside, quickly achieve 600 MW nuclear power generator importing and batch production, and reduce manufacturing costs.

In the area of opening up investment channels, we should give full play to the initiative of central authorities and local areas. The enthusiasm for raising capital to develop nuclear power in energy-short provinces and municipalities in eastern coastal areas has been very high recently. The principles of establishing a nuclear power

construction fund and adopting a principle of "using nuclear power to develop nuclear power" are good methods for developing nuclear power in China.

Nuclear power is a high S&T industry, and we should emphasize concern for S&T progress. Adhere to the spirit of importing, digesting, developing, and innovating. Resolutely integrate attacks on key scientific research topics with importing technologies. We also should formulate nuclear power personnel training plans to guarantee the technical and administrative personnel requirements for developing nuclear power in China.

Pace of Nuclear Power Construction Quickens

906B0057B Beijing JINGJI RIBAO in Chinese 31 Jan 90 p 2

[Article by JINGJI RIBAO reporter Xie Ranhao [6200 3544 3185]: "China Accelerates Pace of Nuclear Power Construction, Qinshan First Stage Project Will Enter Critical Operation Within the Year"]

[Text] Relevant persons revealed on 30 January 1990 that the energy resource shortage compels China to accelerate the pace of nuclear power construction now.

China has a history of formal nuclear power construction which spans more than 10 years but just over 1 year in accelerating development. At the end of 1988, the growing shortage of coal, which accounts for 70 percent of China's primary energy resources, led to several coastal provinces and municipalities which were experiencing energy shortages to make repeated proposals for construction of nuclear power plants, and some have now received state approval.

At the same time, the pace of construction at Zhejiang's Qinshan Nuclear Power Plant and Guangdong's Daya Bay Nuclear Power Plant was speeded up. Most equipment for the first stage project nuclear island and conventional island at Qinshan Nuclear Power Plant is now in place and all of the welding of the main piping is complete. Installation of the other auxiliary systems will soon be finished and preparations are now being made for debugging operation. The overall design for the second stage of the project is now being prepared and its completion is expected soon. Over 65 percent of all the work involved in the main capital construction project for the No 1 generator at Guangdong's Daya Bay Nuclear Power Plant has been completed and the domed roof for the No 1 reactor plant building was successfully installed by a crane on 21 September 1989.

To enable more rapid development of nuclear power construction in China during the 1990's and make breakthroughs in quantity and quality, indications are that the China Nuclear Industry Corporation will again speed up the pace of construction of nuclear power plants now being built during 1990. Arrangements already made call for completion of the primary circuit equipment and system pressurization tests for the first stage project at Qinshan during March 1990, installation of the nuclear fuel in August, initiating critical operation in early November, and increasing power and achieving connection to the grid and power generation in December. Peak installation of the No 1 reactor at Daya Bay Nuclear Power Plant will begin. Emplacement of the pressure vessel will be completed in February and capital construction for the No 2 reactor will be nearing completion. The ring crane will be installed in May and installation of the domed roof crane will be completed. The containment vessel will be sealed in October.

Apart from this, in regard to building another 300 MW generator added to the existing scale of Qinshan Nuclear Power Plant, construction of a nuclear power plant in Liaoning Province, and other matters, the China Nuclear Industry Corporation will conduct research with Shanghai, Liaoning, and other relevant provinces and municipalities to decide on capital raising programs and do preparatory work prior to construction.

Nuclear Power Said Solution to Southeast's Ravenous Electricity Appetite

906B0057C Nanjing JIANGSU KEJI BAO in Chinese 14 Feb 90 p 4

[Article by Hua Wen [5478 5113]: "Developing Nuclear Power, the Basic Way Out for Southeast China's Energy Resources"]

[Text] Some regions of southeast China are both the nation's biggest energy resource consumers and the poorest regions in energy resources. Many experts feel that the basic solution to the energy problems of southeast China is to accelerate development of nuclear power.

At the recent "Natural Gas and Southeast Nuclear Power Development Conference," the relevant experts presented their views on the necessity and possibility of developing nuclear power in southeast China.

Chen Zhaobo [7115 5128 0590], assistant general manager of the China Nuclear Industry Corporation, feels that all areas of China should develop the corresponding categories of energy resources on the basis of different geographical conditions. Southwest China, rich in water sources, should focus on hydropower, northeast and northwest China, with greater concentrations of coal mines, should focus on coal-fired power, and areas of southeast China which lack coal and have few water sources should focus on nuclear power.

Surveys have shown that proven coal resources in east China account for 6.2 percent of China's total coal reserves, while the region's hydropower resources account for less than 5 percent of total hydropower resources in China. Moreover, development would be very difficult and the investment costs high.

China is now using 40 percent of its annual railway transport capacity to haul coal from north to south China, but the energy resource shortage in China's

southeast coastal region which has relatively developed industry and agriculture is becoming increasingly serious. The relevant data show that Jiangsu, Fujian, Anhui, Zhejiang, Jiangxi, and other provinces of southeast China have a total yearly power shortage of more than 16 billion kWh! Still, in comparison to its lack of coal resources, the east China region is located in the multiple metal mineralization zone which encircles the Pacific Ocean. Nearly 100 uranium ore deposits and six uranium ore fields have been discovered and five uranium mines have been built in east China.

Forecasts by relevant experts indicate that building seven or eight nuclear power plants with an installed generating capacity of 10,000 MW by the year 2000 in east China would substantially reduce the energy resource shortage in this region.

Plans formulated by the Ministry of Energy Resources call for 30 billion kWh of power and over 6,000 MW in installed generating capacity for nuclear power in China by the end of this century. Besides Qinshan and Daya Bay, China will also build nuclear power plants in Guangdong, Nanjing, and other areas.

Figures Released on Export of Nuclear Fuel

906B0062A Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 9 Mar 90 p 2

[Article by Wang Yunhua [3769 5686 5478]: "China Exporting Nuclear Fuel to Western Nations, China Atomic Energy Industry Corporation Trade Volume Totals $500 Million Over 10 Years"]

[Text] In the 10 years since the China Atomic Energy Industry Corporation was established, it has striven to promote international cooperation in nuclear power and nuclear technologies and opened a path for Chinese exports of nuclear fuel to Western nations. The total import/export trade volume over 10 years was $500 million.

The China Atomic Energy Industry Corporation, born via a shift to civilian production in China's national defense industry and reform of the foreign trade system, has been managed through a commission system. For 10 years the corporation has adhered to the principles of integrating industry and trade, integrating technology and trade, focusing on the nuclear industry, and economic diversification. This has resulted in excellent quality products for Chinese nuclear fuel to enter international markets and we have exported them to nuclear power companies in the Federal Republic of Germany, France, Belgium, Finland, the United States, and other countries. We have also provided Japan, Chile, and other countries with uranium for scientific research purposes. All of these nuclear fuels have been utilized under the supervision of the International Atomic Energy Agency. Technical product exports for use in the nuclear industry show the strength of China's nuclear resources and nuclear technologies and have attracted world attention.

This corporation was the fuel supplier for Guangdong's Daya Bay Nuclear Power Plant. Using flexible trade arrangements, they imported over 10 production lines of various types for the shift to civilian production in the nuclear industry, and they imported high-technology products like lithium batteries, high-precision battery flow meters, photomultiplier tubes, magnetometers, and so on which have raised China's nuclear energy technology to new heights.

The business volume of the China Atomic Energy Industry Corporation has grown at an annual rate of over 10 percent over the past several years, and the import-export trade volume reached $60 million in 1989. Under the principle of equality and mutual benefit, the corporation has established friendly exchanges and trade cooperation with over 40 nations and regions and over 100 companies and commercial agencies in the world.

Progress on Daya Bay Nuclear Power Plant Noted

Figures Released on Construction

906B0062B Guangzhou NANFANG RIBAO in Chinese 8 Apr 90 p 1

[Article by reporter Chen Bingying [7115 4426 5391]: "Major Advances in Construction of Guangdong Nuclear Power Plant, Nearly 7 Million Cubic Meters of Earthworks Completed, Equal to Almost 90 Percent of Project Total"]

[Text] Big new advances have been made in construction of the Daya Bay Nuclear Power Plant project over the past one-half year and project quality has been consistently maintained at excellent levels. This was announced at a news conference for Chinese and foreign reporters on 7 April 1990 by Zan Yunlong [2501 0061 7893], manager of the Guangdong Nuclear Power Plant Joint Venture Corp., Ltd.

Construction of Daya Bay Nuclear Power Plant is entering its sixth year. To date, nearly 7 million cubic meters of earthworks has been completed, almost 90 percent of the project total; 82 percent of the total engineering for the main plant building structures has been completed; the roof of the No 1 reactor plant building was sealed in September 1989 and the roof of the No 2 reactor plant building will be sealed in May 1990. Some 32,409 tons of equipment and instruments for the nuclear island, conventional island, and other equipment have been shipped from Europe to Daya Bay, equal to 56 percent of the total amount to be shipped. The reactor, nuclear fuel, nuclear auxiliary, and other plant buildings for the No 1 generator have entered the full installation stage and installation of part of the equipment and systems for the No 2 generator has begun. In addition, the first group of 47 first-level production personnel sent to France for training has been issued French certification licenses.

500,000-Volt Transformer Substation Described

906B0062C Guangzhou NANFANG RIBAO in Chinese 8 Apr 90 p 1

[Article by reporter Fang Zhongzhu [2455 0022 3796]: "A Repeat Performance by South Guangdong's Energy Resource Industry—Construction Begins at a Matching 500 kV Nuclear Power Storage Power Station Project"]

[Text] A mobilization meeting to begin construction on Guangdong's matching 500 kV nuclear power storage power station transmission and transformation project was convened in Guangzhou on 7 April 1990. This opened the curtain on construction of Guangdong's biggest matching power transformation project.

This project has a total of seven 500 kV power transmission lines more than 590 kilometers long. They run from Guangdong Nuclear Power Plant to Shenzhen, Shenzhen to Shajiao, Shajiao to Zengcheng, Zengcheng to Foshan, from the nuclear power plant to Zengcheng, from the Guangzhou Pumped-Storage Power Plant to Zengcheng, and from the power storage station to Foshan. Three new 500 kV power transformer stations will be built (at Shenzhen, Zengcheng, and Foshan's Duodong). After the projects are completed in groups in 1992 and 1993, the Guangdong Power Grid will have a 500 kV power transmission looped network which will ensure power output from Guangdong Nuclear Power Plant, Guangdong Pumped-Storage Power Plant, Shajiao Power Plant, and others, so it is extremely important.

Additional Figures Released on Construction

906B0062D Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 10 Apr 90 p 1

[Article by reporters Huang Jichang [7806 7139 2490] and Lian Jintian [6647 6930 3240]: "Construction Proceeding Smoothly at Daya Bay Nuclear Power Plant, No 1 Generator Enters Full Installation Stage, Roof of No 2 Reactor To Be Sealed Soon"]

[Text] Since the roof of the No 1 reactor plant building at Daya Bay Nuclear Power Plant was sealed in September 1989, major advances have been made in project construction. The nuclear island and conventional island for the No 1 generator have entered the full installation stage and preparations are being made for sealing the roof of the No 2 reactor.

Daya Bay Nuclear Power Plant is China's biggest nuclear power plant, with total project investments of $4 billion. The system design and equipment for Daya Bay Nuclear Power Plant are to be turned over in 1990, and this will be the peak installation period, with 60 percent of the total installation being completed. Over 32,000 tons of nuclear island and conventional island equipment manufactured in England and France have been shipped to the worksite, equal to 56 percent of the total freight volume. Eighty-two percent of the civil engineering for the main plant building has been completed. We entered the No 1 reactor plant building during our visit and saw that the enormous nuclear island steam generators had already been transported in and that preparations are in progress for shipping in and installing the huge reactor. Information provided to us indicated that the marine engineering, debugging work, personnel training, and other work is proceeding according to plan. A quality supervision management team with over 300 members has been established. The results of hundreds of inspections indicate that the quality of the project is being maintained at excellent levels. Emergency plans for the worksite are now being formulated. Projections indicate that the No 1 generator can go into formal operation in October 1992 and the No 2 generator will formally begin generating power in July 1993.

While pushing forward with construction, the Guangdong Nuclear Power Plant Joint Venture Corp., Ltd., which is responsible for project construction, has reinforced comprehensive quality management and established and perfected installation quality assurance, quality control, and quality supervision systems. Over 1,000 strict quality assurance inspections and examinations were made for all project links between September 1989 and February 1990. The results show that the quality of the project is excellent.

Hundreds of foreign experts are at Daya Bay Nuclear Power Plant. Information shows that Chinese personnel have consistently maintained excellent relations with them.

Qinshan Nuclear Power Plant Enters Debugging Phase

First Fuel Assemblies Arrive

906B0063A Shanghai JIEFANG RIBAO in Chinese 11 Mar 90 p 1

[Article by JIEFANG RIBAO reporter Sang Jinquan [2718 2516 3123]: "First Group of Chinese-Made Nuclear Fuel Assemblies Safely Transported to Qinshan Nuclear Power Plant"]

[Text] This reporter learned from Qinshan Nuclear Power Plant that the first group of 10 assemblies from the first heat of nuclear fuel assemblies shipped from Sichuan has been safely transported to Qinshan.

This group of nuclear fuel assemblies was developed and produced by Plant 821 of the Nuclear Industry Corporation. After passing state-level inspection and acceptance at the plant gate, they were shipped over 3,000 kilometers by railroad to Jinshan intermediate transfer station and then transported to Qinshan. All of them have now been brought into the plant building and are hanging from a storage rack in preparation for installation into the reactor. This shows that Qinshan Nuclear Power Plant, designed and built by China itself, will rely entirely on Chinese-made fuel assemblies.

The first heat of nuclear fuel assemblies contains a total of 121 assemblies. All of the remaining 111 assemblies will be shipped to Qinshan by the end of July 1990 to ensure that the nuclear power plant will begin operating before the end of this year.

Nuclear fuel assemblies are key components which release energy in a nuclear power plant reactor. The "nucleus" of the nuclear fuel assemblies used in Qinshan's 300-MW PWR [pressurized water reactor] nuclear power plant is composed of uranium-235 and uranium dioxide sintered into ceramic components in the form of a dual butterfly in a cylindrical shape 10 mm long and 8 mm in diameter. The ceramic components are packed at a specific spacing inside an alloy tube almost 3 meters long. The alloy tubes are arranged in a 15 x 15 array to make one assembly. The first heat of nuclear fuel assemblies can be used for 330 days after they are installed in the reactor and begin operating. After this, only 40 of the assemblies will have to be replaced each year at specific times.

First Group of Operators Trained

906B0063B Shanghai JIEFANG RIBAO in Chinese 11 Mar 90 p 1

[Article by JIEFANG RIBAO reporter Sang Jinquan [2718 2516 3123]: "China's First Nuclear Power Operating Staff Is Born, They Undergo Strict Training and Examination in China and Foreign Countries"]

[Text] Chen Songtao [7115 2646 3447] is an engineer with over 10,000 hours of on-duty nuclear reactor operating experience. He is now the first shift leader in the main control room at Qinshan Nuclear Power Plant. His 30-plus coworkers have also taken operating positions in the main control room. This is an indication that China's first nuclear power plant operating staff has been born.

Operating personnel for Qinshan Nuclear Power Plant were recruited in 1984 and 1985. Almost all are top-quality undergraduates who graduated from universities after 1984. There are few engineers and senior engineers like Chen Songtao. They were selected directly from nuclear fuel production plants and nuclear scientific research departments. Training of operating personnel for Qinshan Nuclear Power Plant formally began in June 1986.

Chen Songtao told this reporter that although he has experience operating nuclear reactors, he basically had to start studying from the beginning because of differences in reactor types, systems, and control. Because university reactor engineers and university students who graduated from thermonuclear power, power generation and distribution, and other specializations lacked actual operating experience, their training was even stricter. This reporter saw a nuclear power plant operator "Guide to Essential Knowledge" compiled in the United States that contained 5,500 items, which gives a sense of the difficulty of the training the operating personnel received.

Around 1987, 40 operating personnel were sent to foreign countries in groups at different times for training. They first received training on a full-scale simulator in Spain, which included a simulation of the entire process involved in the accident at the Three Mile Island Nuclear Power Plant in the United States. After 9 weeks, all of them passed their examinations and received Spanish certifications as nuclear power plant operators. Next they went to Krsko Nuclear Power Plant in Yugoslavia for on-the-job study. After 3 months of regular shifts and rotating shifts, they added a great deal of perceptual knowledge and came into contact with all nuclear power plant operating regulations.

Tight and thorough arrangements were also made for their training in China. The International Atomic Energy Agency made a "pre-operation safety inspection" of Qinshan Nuclear Power Plant in April 1989. Typical remarks concerning operator training work were that the training was conducted according to international standards, the organization and administration were very effective, and the training satisfied the requirements of the relevant regulations.

Senior engineer Tian Peiliang [3944 0160 5328] of the Qinshan Nuclear Power Company Training Center said that the operators will also go to Beijing's Nuclear Plant Simulator Training Center for retraining and re-examination by a specialized testing committee. During the first 2 months of core loading at the reactor at Qinshan Nuclear Power Plant, the State Nuclear Safety Bureau will issue operator's licenses.

The Qinshan Nuclear Power Company Training Center has prepared a principles-type simulator for educational purposes at the training base area for main control room operating staff at China's nuclear power plants. It can simulate the main operating procedures at nuclear power plants, in particular the emergency operating system for nuclear reactors. This will provide operators with their own "training ground" for training and re-training.

Overview of Project

906B0063C Beijing GUANGMING RIBAO in Chinese 22 Mar 90 p 1

[Article by GUANGMING RIBAO reporters Xie Jun [6720 6511] and Ye Hui [0673 6540]: "Qinshan—China's Nuclear Power Industry Is Rising Here"]

[Excerpts] Gratifying news has come from Qinshan Nuclear Power Plant in the past few days. The first group of 10 nuclear fuel assemblies produced by China itself were hung from their storage racks on 2 March 1990 and the nuclear power plant will be entering the comprehensive debugging stage.

This is encouraging news. The first nuclear power plant designed and built by China itself has been erected, telling the world that China's history of a lack of nuclear power has ended!

I

Qinshan, a small unknown mountain in Zhejiang Province's Haiyan County, is now a locus of attention in China and foreign countries.

Traveling by car 8 kilometers southeast of Haiyan County along the shores of Hangzhou Bay, the 300-MW nuclear power plant stands erect next to the mountain and the sea. March at Qinshan is sunny and calm, and from afar one can see smokestacks jutting into the clouds and the containment building standing like a blockhouse. Capital construction tasks for the entire Qinshan Nuclear Power Plant project are basically complete and installation tasks are nearing completion. Of the more than 5,000 pieces of equipment, over 9,000 instruments, and 10,000-plus valves, 95 percent are "sitting in the right seats." The 800 kilometers of electrical cable and 110,000 meters of piping have been put in place, and the project will be entering the comprehensive debugging stage.

The 39 operators who trained and studied on simulators in foreign countries have taken up their operating positions. These top-quality undergraduates who graduated from college 5 or 6 years ago now fully understand the 5,500 items of essential knowledge for nuclear power plants compiled in the United States. After random inspection of this group of operators by experts from the International Atomic Energy Agency, every operator was able to answer any question in fluent English. As China's first group of operators, their appearance indicates that China's nuclear power technical staffs are taking shape. [passage omitted]

III

Seven years have passed. Looking at the nuclear power plant taking shape, Shi Guozhen [2457 0948 2823], director of the Qinshan Nuclear Power Company office, said emotionally: Who at Qinshan could forget these past few years. Actually, everything today was obtained only by the builders overcoming problem after problem.

Qinshan was opened up in a straight line and a 24-meter-deep foundation was excavated by digging straight down to the bedrock because the nuclear power plant had to be set on bedrock. Over 1.2 million cubic meters of solid rock was excavated.

As soon as the project began, it encountered a major technical problem. A large area of concrete more than 80 meters square had to be poured on uneven bedrock more than 20 meters deep, and without a single crack. This had never been done in the history of structural construction in China. When technical personnel in Company 22 of the Nuclear Industry Corporation were assigned this task, they had only 3 months' time to complete it, but foreign experts asserted that this type of project could not be done even in 7 months. The situation allowed no hesitation. They immediately began doing technical survey research and speeded up their experiments. Eventually they found a new method and the task was completed in its entirety in a little over 3 months. They created a miracle in large-area concrete crack-prevention construction technologies in China. A re-inspection after 3 years still did not find a single crack.

Reliance on their own efforts was the steadfast conviction of the nuclear power plant builders. When the project moved into the installation stage, another major technical problem appeared: problems in welding the main pipes of the primary loop in the reactor. This was one of the projects in the entire installation engineering that had the highest technical demands, greatest difficulty, and most complex technologies. The welding error in fitting the 840 x 70 mm stainless-steel pipes to the equipment could not exceed 0.05 mm. To ensure quality, project directors agreed to foreign consultations. However, one country wanted US$200,000 in consulting fees from the start. Another country wanted only $80,000 but it wanted the Chinese government to become involved in the negotiations. Technical personnel in Company 23 of the Nuclear Industry Corporation refused to be taken in by these fallacies and decided to do it themselves! They chose 10 people from among more than 100 of the best arc welders, trained them for a year and a half, put them through repeated simulation experiments, obtained more than 6,000 pieces of data, compiled over 50 programs which they searched through gradually and eventually gained a grasp of the laws, overcame the difficulties, and did the welding successfully on the first try!

Installation of the reactor containment vessel was nothing ordinary. The domed roof was 36 meters in diameter, 9 meters high, and weighed 142 tons. Lifting such a huge thing to a height of 62 meters was extremely difficult. Foreign countries use a special 8,000 tons/meter caterpillar tracked crane, but it is said that there are only two of these cranes in all of France and each unit costs over $20 million. Company 23's chief engineer Wang Zhongqin [3769 0022 0530] and his colleagues worked together to study alternatives and eventually substituted a 100-ton tower crane to successfully overcome this problem.

IV

In April 1986, there was a serious nuclear leakage accident at the Soviet Union's Chernobyl Nuclear Power Plant. For a while, a nuclear fear spread worldwide. At the time, many people in China and foreign countries had doubts about construction of the Qinshan Nuclear Power Plant. Group after group of people came to visit and visitor after visitor asked if Qinshan Nuclear Power Plant could ensure that there would be no accidents. Could a Chernobyl-type tragedy occur here?

When the visitors understood that all the equipment at the nuclear power plant had been installed and saw the various radiation-prevention measures, and especially when they understood the high spirit of responsibility of the engineering and technical personnel concerning safety and quality, they were put at ease.

China had no information and no experience concerning nuclear power construction and foreign countries practiced strict secrecy, but these problems did not stop China's design personnel. They used the principle of "no contamination of our national territory and no danger to the people" and adopted radiation-prevention measures of "comprehensive preventions, multiple screens, no chances of failure." Under the leadership of senior engineer Ouyang Yu [2962 7122 0056], chief designer Tong Dingchang [4547 7844 2490] who was responsible for the reactor design, and many other design personnel who buried themselves in explorations, over 100 experiments were conducted and more than 20,000 pieces of data were obtained. The reactor they designed has three sealing screens: fuel casings, a pressure vessel, and a containment vessel. Comprehensive consideration was also given to earthquake protection, protection against typhoons and tides, and other irresistible natural factors. Looking at its enormous outer vessel standing erect in the blue sky, an engineering technical said the containment vessel would not be damaged even if an aircraft crashed into it.

Senior engineer Ouyang Yu said that construction and startup of the Qinshan project would not just add 300 MW to China's power-generating capacity. Even more important is that through this project, we have acquired experience and firsthand information throughout, from scientific research, design, and construction and on to debugging and operation. We have also trained staff and formed a preliminary nuclear power S&T system and industrial construction capacity in China.

China's nuclear power industry is rising at Qinshan.

Li Peng Inspects Facility

906B0063D Beijing RENMIN RIBAO in Chinese 16 Apr 90 p 1

[Article by reporter Huang Guowen [7806 0948 2429]: "Premier Li Peng Inspects Qinshan Nuclear Power Project, Points Out That Completion of the Nuclear Power Plant Will Indicate that China's Nuclear Power Industry Has Moved Up to a New Stage, Emphasizes That High Standards and Strict Demands in Training Operating Personnel Will Ensure Normal Operation"]

[Text] Hangzhou, 15 Apr (XINHUA)—State Council Premier Li Peng inspected the Qinshan Nuclear Power project on 14 April and discussed current economic work with responsible comrades in Zhejiang Province and Baoxing City.

This was Premier Li Peng's second inspection of the Qinshan nuclear power project.

Premier Li Peng visited the nuclear reactor, conventional gas turbines and generators, and other main project sites and gained a detailed understanding of construction progress, technologies, quality, and other aspects for the central control room. He also listened to detailed reports from project officials. He said that on this visit to Qinshan, he saw that the project was progressing smoothly, that all indications were that the quality of the project was good and it would be entering the debugging stage. The morale of all the cadres and employees was inspiring and made him happy. He used this occasion to pay his cordial respects to all the comrades responsible for building this project.

Li Peng said that this nuclear power plant was the first nuclear power project designed and built by China itself, so everyone was quite concerned. Successful construction of this nuclear power plant will indicate that China's nuclear power industry has moved up to a new stage and will surely provide great encouragement to all the people of China. He hoped that everyone will continue to work hard and do their work even better.

While project officials were reporting on their work in the next stage, Li Peng stressed that they must certainly ensure project quality, especially in the forthcoming debugging system. They must not rush its completion and must do the debugging work in strict accordance with procedures and standards to that they immediately discover and solve problems in the project that the project goes into operation smoothly and functions safely.

He also called for Qinshan Nuclear Power Plant to train operators according to high standards and strict requirements to give them a high degree of a sense of responsibility, a serious working style, and excellent technical levels. These three things are essential for ensuring that the nuclear power plant operates normally.

While meeting with leading comrades from Zhejiang Province and Baoxing City, Comrade Li Peng said that China's economic situation continues to improve, but that one problem now was how to find a suitable point of integration between maintaining an appropriate rate of development and maintaining stable materials prices, as well as adopting the corresponding measures to achieve a basic solution to the problems of a market sales slump and suitable and stable growth of industrial production and the economy as a whole. He affirmed efforts by Baoxing City at accelerating readjustment of the industrial structure and developing products with appropriate sales outlets. He said that studying and solving economic problems cannot be done in a case-by-case manner, but must instead involve comprehensive consideration in many areas. We must mobilize the masses in a broad fashion to think of methods and suggest ideas. Only through the joint efforts of everyone is there any significant hope of solving problems.

While passing through Haiyan County, Li Peng met personally with delegates to the county CPC Congress then in session. He told everyone that Baoxing Prefecture and Haiyan County are important grain and cash crop producing areas in a rich and populous region that has made positive contributions to supporting national economic construction. The agricultural policies of the CPC and Chinese government will not change. We will

continue to implement the household responsibility system and develop township and town enterprises, and we will continue to provide many types of agricultural service systems. Regions having the proper conditions should, according to the principle of peasant voluntarism, stably develop suitable scale administration and a new collective economy. This will enable us to achieve better rural construction, make everyone's lives more prosperous, and make greater contributions to the state.

Chief Designer Ouyang Yu Interviewed

906B0063E Beijing RENMIN RIBAO in Chinese 18 Apr 90 p 2

[Article by reporter Chen Jianfa [7115 1017 4099]: "Construction of Qinshan Nuclear Power Plant Enters Final Stage, the Historical Absence of Nuclear Power on the Chinese Mainland Will End; Excellent Safety Characteristics Can Handle Extreme Accidents and Resist All Types of Natural Disasters"]

[Text] Hangzhou, 17 Apr (XINHUA)—Construction is now being speeded up at Qinshan Nuclear Power Plant, the first nuclear power plant designed and built by China itself, and it is now entering the final installation and debugging stage.

What this reporter saw at Qinshan was a living picture of China's modernization and construction. On a formerly desolate beach, an 1,800-meter-long large sea dike has appeared, locking out the rolling sea. On the arrow-straight cement road in the plant area, all types of construction vehicles are moving back and forth and row after row of tall plant buildings are now springing up along both sides of the highway. In the "brains" of the nuclear power plant, the central control room with its magnificent and stylish instrument console several tens of meters long, technical personnel are carefully connecting tens of thousands of "nerves." In the plant building, most of the 1,000-plus pieces of equipment to be installed are now "sitting in the right seats." The 110,000 meters of pipelines and over 800 kilometers of electrical cables are now in place. The more than 5,000 builders gathered here from all over China are now working speedily and orderly at their posts.

The builders of the Qinshan nuclear power project know that their 5 years of hard work will bring great successes and the Chinese mainland's historical lack of nuclear power will end in their hands!

The senior designer of Qinshan Nuclear Power Plant is 62-year-old Ouyang Yu. He has thick eyebrows and black hair, stirs a wind beneath his feet as he walks, and speaks quickly and alertly. In the early 1960's, he was the senior engineer responsible for designing China's first military reactor. His concise answers described the development history of new China's nuclear power industry: "Premier Zhou Enlai was the first to propose building nuclear power plants. In the early 1970's, Premier Zhou pointed out that we should make peaceful use of nuclear energy and build nuclear power plants! He also proposed the construction principle of 'safe, practical, economical, and relying on our own efforts.' From that instant, China began doing a great deal of preparatory work for building nuclear power plants. The design for Qinshan's 300-MW nuclear power generator meets international standards of the late 1970's and early 1980's. It employs a pressurized-water reactor (PWR), which is now a technically mature technology over the world.

"Safety was given first priority throughout the design and construction of Qinshan Nuclear Power Plant. Within the radioactive nuclear building, three-level screening employing fuel cladding, a pressure vessel, and a containment vessel is used. The containment vessel has excellent sealing properties and can withstand the internal pressures and high temperatures caused by extreme accidents as well as the shock of tornadoes, earthquakes, and other natural disasters and the impact of an aircraft...

"Construction of Qinshan Nuclear Power Plant can reduce east China's power and coal shortages and improve the level of industrial modernization in China. Even more important is that it has drilled and trained China's own nuclear power construction workforce and raised China's modern S&T to a new level. This will move China into the ranks of superpowers capable of building nuclear power plants."

As a fact, this reporter saw hundreds of China's brave fighters involved in nuclear power research and construction assembled here. They are treating the Qinshan nuclear power worksite as their own classroom and battlefield. They are studying, exploring, and building all at the same time. They have drawn over 100,000 blueprints and overcome thousands of key technical problems. Staying at the worksite gives one a powerful impression that what is coming to life on the banks of Hangzhou Bay and at the foot of Qinshan is not just a nuclear power plant built through reliance on our own efforts: It is also creating a new generation of people in China's nuclear power industry.

Qinshan is becoming the cradle of the republic's nuclear power industry!

Additional Overview, More on Ouyang Yu

906B0063F Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 20 Apr 90 pp 1-2

[Article by KEJI RIBAO reporter Huan Jianxin [1360 1696 2450]: "Crystallized Wisdom—A Record of Qinshan Nuclear Power Plant, Designed and Built by China Itself"]

[Excerpts] Qinshan is a relatively unknown place. Today, construction of the first nuclear power plant designed and built by China itself has brought it world attention.

Qinshan is located in Zhejiang Province. In his day, Emperor Qinshi Huang climbed it to look out over the vast sea during his eastern travels.

Standing on top of Qin Shan [Mount Qin], just seeing the three layers of sea dikes 1,800 meters long and 9 meters high running east to west is a magnificent sight. The cylinder of the nuclear plant's containment vessel stands upright and the reactor auxiliary plant building, nuclear fuel building, main control building, and other structures rise from the ground. The first batch of concrete for the main reactor plant building was poured on 20 March 1985, indicating the formal start of the project construction stage. In just 5 years, Qinshan Nuclear Power Plant has taken shape. Experts from the International Atomic Energy Agency said in assessing the pre-operational safety of the project that "although this is China's first nuclear power plant built by itself, the work completed to date is of high quality." [passage omitted]

II. Not Betraying a Great Trust in Nuclear Power Plant Design

In October 1971, Dr Ouyang Yu, China's first senior design engineer for large-scale military reactors, was invited to Beijing. Liu Wei [0491 0251], minister of the Second Ministry of Machine Building at that time, told him: "Shanghai wants us to help them with a senior engineer, and they want you to come to Shanghai immediately." Several accomplished nuclear industry specialists accompanied him.

The choice of the type of a nuclear power plant was a prerequisite for correct design. After research, Ouyang Yu boldly rejected the previous molten-salt reactor program. He said: "This is an idea proposed after theoretical exploration by nuclear experts in foreign countries. It cannot be used to build a nuclear power plant." At a meeting of the Special Central Commission convened by Premier Zhou Enlai on 31 March 1974, the pressurized-water reactor (PWR) nuclear power plant program proposed by Ouyang Yu was approved. This session of the Special Central Commission was a turning point in nuclear power plant design and construction. The nuclear power plant design subsequently entered the research design stage.

A nuclear power plant involves over 100 engineering items composed of large numbers of equipment, components, instruments, gauges, and pipeline system. "Integrate with China's national conditions, integrate with other plants, take our own road in design." Ouyang Yu solemnly and boldly proposed the guiding design principle of integrating design with scientific research, experiment, and development. He said: "Solving key technical problems in preparing our own design depends on doing our own R&D so that we know the hows and the whys and grasp the power of technical initiative."

China's brave fighters in nuclear power research were assembled under Ouyang Yu's command. They focused on the approved program of principles and did repeated explorations and analytical research to solve the key S&T problems, and proposed 264 scientific research experiments and projects to attack key technical problems.

In conjunction with the design for Qinshan Nuclear Power Plant, nearly 100 research institutes, design academies, institutions of higher education, and plants throughout China took over scientific research and development tasks assigned by the State Planning Commission for joint cooperation in attacking key problems. In Shanghai Municipality alone, there were over 700,000 workers involved in equipment design and manufacture. It can be said that the start of the design for Qinshan Nuclear Power Plant embodied the spirit of national cooperation.

More than 40 types of new materials proposed for the design program for Qinshan Nuclear Power Plant had to be developed. The most important parts were the reactor pressure vessel, steam generators, and so on. These pieces of equipment were prepared by welding together large forged components. These forged components weighed tens of tons. The steel ingots had to weigh more than 100 tons, and they had to have high strength and good welding properties as well as good plastic toughness. After the tasks were assigned, the Shanghai Steel Institute organized more than 10 units including the Beijing Steel Academy, Shanghai Boiler Plant, Shanghai Heavy Machinery Plant, Shanghai Arc Welding Rod Plant, and others for a joint attack on key problems in development. They eventually developed a new type of low-alloy steel. Over 10,000 pieces of data were obtained in the laboratory and semi-industrial production, and they followed with industrial testing of this type of steel. Inspections showed that this type of steel has properties comparable to the forged materials used in the United States.

As the project design and construction intensified and our understanding of nuclear power plant safety continued to improve, an additional 100-plus scientific research and experiment items were added, raising the total to 380 items. The large amount of scientific research work assured smooth progress in design, equipment manufacture, and construction.

When the designers completed the design and prepared blueprints, they also carried out a self-inspection. The Ministry of Nuclear Industry organized 238 people from 13 units to focus on the three levels of screening (containment vessel, main-loop pressure margin, and fuel assemblies), the two systems (reactor control system and cooling system), and the one interface (the interface between the nuclear plant and the conventional plant) by dividing into 16 specializations for a re-inspection of the design.

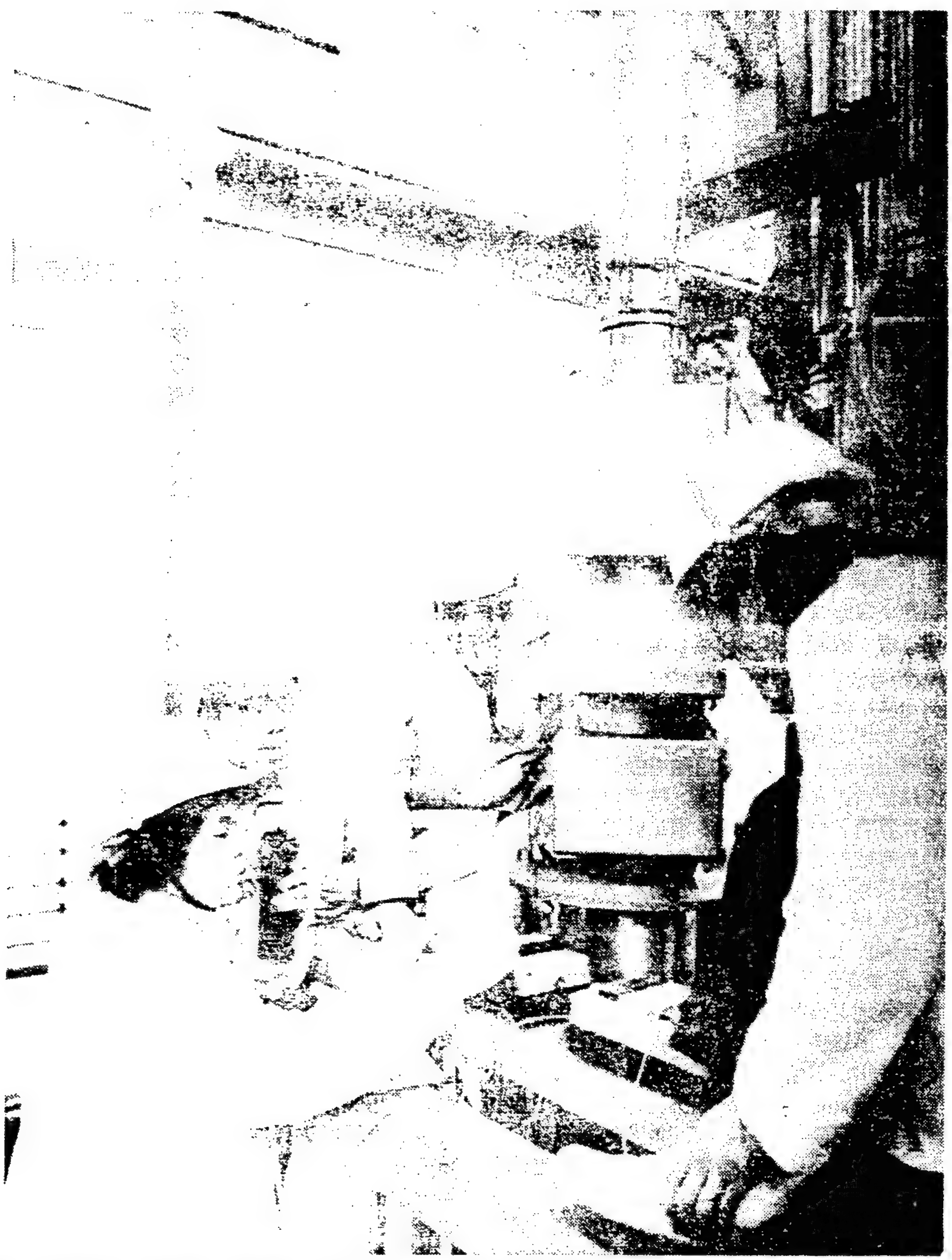
The designers of the nuclear power plant did not betray a great trust. The design in the blueprints was for the most part realized through the struggle of over 4,000 nuclear industry builders. One expert who participated

in the design, completely unable to conceal his excitement, said: "Victory is in sight for Qinshan Nuclear Power Plant, the first designed and built by China itself." [passage omitted]

Photographs

906B0063G Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 20 Apr 90 p 4

[Text]



Control drive equipment being installed in the reactor. Guided by the automatic control system, it will effectively control reactor power. The photo shows S&T personnel from the Shanghai Nuclear Engineering Research and Design Academy working with engineering and technical personnel from the equipment production plant and nuclear power plant to carry out vibration measurement and analysis.

Chinese engineering and technical personnel and an expert from the Federal Republic of Germany's KSB Corporation installing a nuclear reactor coolant pump.-

Nation Has Great Solar Power Potential

906B0059B Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 26 Nov 89 p 4

[Article reprinted from JINGJI CANKAO [ECONOMICS REFERENCE] No 2659: "China Has Excellent Solar Power Resources"]

[Text] Analysis of meteorological data covering about 20 years at nearly 700 stations throughout China shows that the distribution of China's solar power resources can be divided into five regions:

Category 1 regions: Annual number of sunshine hours 3,200 to 3,300 hours, annual radiation 1.6 to 2.2 million kilocalories/square meter. These mainly include the Qinghai-Tibet Plateau, northern Gansu, northern Ningxia, western Xinjiang, and other areas. These regions have the most abundant solar power resources in China. This is particularly true for Tibet with its high terrain and intense solar radiation. Lhasa in particular is world-renowned as a city of sunshine.

Category 2 regions: Annual number of sunshine hours 3,000 to 3,200 hours, annual radiation 1.4 to 1.6 million kilocalories/square meter. This category mainly includes northwest Hebei, north Shanxi, Inner Mongolia, and eastern Ningxia and Gansu. It is a region of China which has rather good solar power resources.

Category 3 regions: Annual number of sunshine hours 2,200 to 3,000 hours, annual radiation 1.2 to 1.4 million kilocalories/square meter. This category mainly includes Shandong, Henan, west Hebei, south Hebei, north Xinjiang, northeast China, north Jiangsu, and other areas. It is an intermediate level region in China in terms of solar power resources.

Category 4 regions: Annual number of sunshine hours 1,400 to 2,200 hours, annual radiation 1.0 to 1.2 million kilocalories/square meter. This category mainly includes the middle and lower reaches of Chang Jiang and parts of Fujian, Zhejiang, and Guangdong.

Category 5 regions: Annual number of sunshine hours 1,000 to 1,400 hours, annual radiation 0.8 to 1.0 million kilocalories/square meter. This category mainly includes the east Sichuan and Guizhou regions. It is a region of China with rather poor solar power resources.

It is apparent that two-thirds of China's regions have 2,000 hours of sunshine and annual radiation of more than 1.4 million kilocalories/square meter, which are excellent solar power resources.

Status of Wind Power Utilization Reviewed

906B0059A Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 29 Mar 90 p 8

[Article by Guo Xiuchen [6753 4423 5256] reprinted from HUANJING BAO [ENVIRONMENTAL REPORT] No 193: "Current Situation for Wind Power Utilization in China"]

[Text] Wind power is a non-polluting renewable energy resource that is "not exhausted by being used." China has estimated total surface wind energy of 1.6 million MW, with at least 160,000 MW available for use. This enormous potential energy resource offers broad prospects for development and utilization.

Regions where wind power can be utilized cover 50 percent of China's total area. The richest areas are along the southeast coast and in northern Inner Mongolia. Regions with relatively abundant wind power include the coast, northern parts of northeast, north, and northwest China, and northern Qinghai Plateau. Most of these regions have strong winds during the winter half of the year and weak winds during the summer half of the year, so they are seasonal utilization regions. Thus, they must be used in conjunction with other energy resources. Relevant experts suggest developing integrated solar power and wind power generators that generate electricity using solar power when there is sun and wind power when there is wind, to take advantage of each. Practice has proven that for an average yearly wind speed of about 3 meters/second, small wind power generators under 1 kW can be developed. From 3.0 to 4.5 meters/second, 10 kW and smaller wind power generators can be developed. From 4.6 to 6.0 meters/second, 10 to 100 kW wind power generators can be developed. For 6.1 meters/second and higher, 100 kW and larger wind power generators can be developed.

China now has over 70,000 wind power generators, most of them small generators of 100, 200, and 500 W. We have several ten medium-sized and large generators of 22, 55, 100, and 200 kW. In agro-pastoral regions, these wind power generators provide electricity to some pastoralists for lighting, televisions, and radio-recorders. At present, 25 percent of China's agro-pastoralist households have no electricity. Most of these regions are in economically backward deep mountains, plains, islands, and other regions where there is abundant wind power. Thus, developing wind power is also quite important for reducing energy resource shortages and improving people's living standards.

Yancheng Develops New Energy Resources

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[Article by Ding Shu [0002 3412]: "Yancheng Prefecture Blazes New Trails in Developing and Using New Energy Resources"]

[Text] Yancheng Prefecture is restricted by its geographical conditions and it has shortages of conventional energy resources that are becoming increasingly acute. Beginning in the 1970's, successive governments in Yancheng Prefecture organized forces to study and develop new energy resources. They established a new Energy Resource Institute, a Methane Extension and Utilization Office, and other scientific research and

leadership organs that have sought ways to develop and utilize new energy resources in a region lacking energy resources.

1. Brilliant Achievements in Extending and Popularizing Methane

Yancheng Prefecture leads the nation in extending and popularizing biogas. The city has built over 100,000 biogas pits that have a normal utilization rate of more than 80 percent. After Fengfu Pig Farm in Dafeng County successfully used biogas to generate electricity in 1978, Jianhu County also built 12 small methane power generation stations with an installed generating capacity of 40.9 kW. Jianhu County's scientific research project on "biogas power generation for oxygenation to achieve benevolent cycles in high output fish ponds" passed examination and approval in September 1978. Biogas extension and utilization provided enormous economic and social benefits and reduced the region's energy shortage.

2. Bright Prospects for Developing Solar Power

Development and production of solar stoves is an important way to develop and utilize solar power in Yancheng Prefecture. TP 2.0-F700 and TP 1.5-F600 solar stoves developed and produced by Yancheng Prefecture Boiler Plant received a superior new product "Golden Dragon Award" from the State Economic Commission in 1983. They also received a first-place award at a national evaluation conference held by the Ministry of Agriculture, Animal Husbandry, and Fishery in 1986. These products are being sold in 29 provinces, municipalities, and autonomous regions in China as well as in Japan, Burundi, Pakistan, and other countries. In 1986, the Ministry of Agriculture, Animal Husbandry, and Fishery decided to make Xinyang Township in Sheyang County and Shizhuang Township in Funing County national solar stove demonstration sites. Development and utilization of solar stoves has opened a new way to provide household energy resources in rural areas.

3. Limitless Prospects for Wind Power Utilization

The average annual wind speed along the coastal beaches of Yancheng Prefecture is about 4 meters/second and the yearly effective wind time is 5,000 hours. After a successful experiment in using wind power to generate electricity at a saltworks in Sheyang County in 1983, it was extended for use on coastal beaches in Dongtai, Dafeng, Binhai, Xiangshui, and other counties. They built 16 wind power generating stations with an installed generating capacity of 3,375 kW which produced 3,050 kWh of power a year [as published]. Wind power development and utilization has provided a local solution to the power shortage on the coastal beaches of Yancheng Prefecture and saved considerable transmission and transformation of electricity. It also effectively reduced production costs, improved enterprise economic results, and effectively promoted development of local agricultural and industrial production.

4. Substantial Potential for Tidal Power

China's Huang Hai contains tidal power reserves of 55,000 MW. Yancheng Prefecture's coastline is 363.75 kilometers long and the average Huang Hai tide is 2 meters, so it has the requisite conditions for using tidal power to generate electricity. Xinhe Village in Xiangshui County's Chen'gang Township built a tidal power generation station in 1971 at a cost of 420,000 yuan. It had two water turbine generators with an installed generating capacity of 300 kW and operated for 15 hours daily. It produced 2.3 MW of power daily and generated power for 3 months, producing a total of 210 MW of power [as published]. Inadequate estimates of tidal silting factors in Huang Hai subsequently forced a shutdown of the generators, but it did provide experience and lessons in utilizing Huang Hai tidal power, so it had substantial scientific research value.

Yancheng Prefecture has done a great deal of work in the area of new energy resource development and utilization, and it has both successful experiences and the lessons of failure. They are very important for developing and utilizing new energy resources throughout China.

5. Improve Understanding, Use Advantages, Avoid Disadvantages

Fully understanding new energy resources as inexhaustible potential energy resources and developing and utilizing them can reduce consumption of conventional energy resources and conserve investments in electric power construction and the cost of transporting conventional energy resources. It can avoid competition by farm and sideline product processing industries and township and town industries with large industries in urban areas for energy resources, and it can help concentrate limited energy resources for faster development of big urban industries. In contrast, failure to develop and utilize new energy resources would be enormously wasteful.

6. S&T Progress, Promoting Development

To promote R&D, extension, and utilization of new energy resources, we must take the path of S&T progress. Relying on technical advances to use natural advantages is essential for getting higher investment results. Yancheng Prefecture's measures involved actively importing advanced S&T, organizing experts and skilled personnel doing research on new energy resources into scientific research organs, centralizing the necessary manpower, materials, finances, and technical forces, seeking breakthroughs in biogas and wind power utilization, and organizing S&T conferences and training classes to foster the initiative and enormous creativity of the masses to promote more intensive and extensive development of new energy resource development and utilization.

7. Adapt to Local Conditions, Foster Advantages

Some 90 percent of Yancheng Prefecture's population lives in rural areas and rural energy consumption has grown year after year. Popularization of biogas in rural areas provides rural household energy resources and reduces contradictions among fuel, feed, and fertilizer. Development and utilization of wind power and tidal power makes rather good use of local advantages. Yancheng Prefecture's geographical location restricts its utilization of solar power, but relevant departments have worked in spite of this by making use of local technical advantages, developing solar powered oven production, and recovering their capital, which has helped with their expenses for transporting in conventional fuels.

For more than 10 years, new energy resource development and utilization in Yancheng Prefecture has promoted industrial and agricultural production and reduced environmental pollution, but there is still considerable potential for developing new energy resources in Yancheng Prefecture. The popularization rate for biogas is still low. The prefecture used 3.204 million tons of straw for fuel in 1987. Development of biogas could reduce burning of ammonium hydrogencarbonate, a raw material for chemical fertilizer, by 189,000 tons. The amount of hydrogen gas discharged by Yancheng Prefecture's synthetic ammonia industry each year is equivalent to an estimated 200,000-plus tons of standard coal. This most ideal clean energy resource remains undeveloped and unused. Yancheng Prefecture's abundant geothermal resources are now being used only for household purposes. Establishment of a geothermal power station which uses ethyl chloride as a "working medium" could provide substantially more electricity and save large amounts of coal. Thus, R&D work for new energy resources requires further extension and popularization as well as intensified research.

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